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THE PRINCIPLES
AND
PRACTICE OF PHOTOGRAPHY

FAMILIARLY EXPLAINED:

BEING A

MANUAL FOR BEGINNERS,

AND

REFERENCE BOOK FOR EXPERT PHOTOGRAPHERS.

COMPRISING

THE COLLODION PROCESS,
PRINTING AND TONING, FERROTYPES, ETC.;

AND

HOW TO MAKE AND MANIPULATE

GELATINE PLATES;

DEFECTS, FAILURES, AND REMEDIES,

ETC., ETC., ETC.

BY JABEZ HUGHES,

PHOTOGRAPHER TO THE QUEEN, H.R.H. THE PRINCE OF WALES, AND THE ROYAL FAMILY

THIRTEENTH EDITION.

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PREFACE

TO

THE THIRTEENTH EDITION.

IN this manual the Author has endeavoured to give simple and clear directions for producing photographs. He has adopted the familiar style, as admitting of the plainest and most homely language. The pupil has always been supposed to be at his elbow. The object has been to remove as many difficulties as possible from the beginner's path, and to render the commencement interesting. There has been no desire, however, to hide from the pupil the difficulties that he may meet with in practice; he is rather prepared for them, and instructed how to meet some and avoid others.

Part I. is confined to elementary manipulations and simple directions; many instructions and suggestions are more fully explained at a later part of the book,

when it may be supposed that, with more extended experience, the pupil will be better able to appreciate them.

Part II. is devoted to dry-plate photography, and as all the old processes have been completely superseded by the gelatine process, this part is entirely given up to its consideration and manipulative details. Its general principles are distinctly stated, and the most useful of them fully described. The subject is treated in its serial or consecutive order, and it is confidently hoped that a little careful attention to the simple details will be sufficient to enable the most inexperienced to become, in a very short space of time, a very creditable manipulator of gelatine plates.

London, March, 1883.



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$1 \text{ lb} = 12 \text{ oz}$
 $1 \text{ oz} = 8 \text{ drs.}$
 $1 \text{ dr} = 3 \text{ scruples} = 60 \text{ grs.}$
 $1 \text{ sc} = 20 \text{ grs.}$

ENGLISH WEIGHTS AND MEASURES.

APOTHECARIES' WEIGHT.

SOLID MEASURE.

60 grains = 1 scruple.
 60 „ = 1 drachm.
 480 „ = 1 ounce.
 12 ounces = 1 pound.

FLUID MEASURE.

60 minims = 1 drachm.
 480 „ = 8 „ = 1 ounce.
 160 drachms = 20 ounces = 1 pint.
 8 pints = 4 quarts = 1 gallon.

N.B.—It is important to remember that in all English photographic formulæ the solid and fluid measures of Apothecaries' Weight are used; but in buying and selling chemical articles the Avoirdupois Weight is employed.

AVOIRDUPOIS WEIGHT.

$27.343 \text{ grains} = 1 \text{ dram.}$
 $16 \text{ drs.} = 437.5 \text{ „} = 1 \text{ ounce.}$
 16 ounces = 1 pound.

TROY WEIGHT.

24 grains = 1 pennyweight
 20 dwts. = 1 ounce.
 12 ounces = 1 pound.

FRENCH WEIGHTS AND MEASURES.

1 gramme weighs nearly $15\frac{1}{2}$ English grains (15.433).
 1 „ = 10 décigrammes = 100 centigrammes = 1,000 milligrammes.
 1 kilogramme = 1,000 grammes = nearly $2\frac{1}{4}$ lbs. avoirdupois (2.247).

1 litre is equal to nearly $35\frac{1}{4}$ fluid ounces (35.2).
 1 cubic centimetre is equal to nearly 17 minims (16.896).
 1 millimetre measures in length 0.0393 inches.
 1 centimetre „ „ 0.393 „
 1 decimetre „ „ 3.937 „
 1 metre „ „ 39.370 „

HOW TO LEARN PHOTOGRAPHY.

A FEW WORDS TO THE BEGINNER.

We are about to commence a course of familiar instruction in Photography. You are to be the pupil, and I am to be the teacher. It is your wish to learn how to make a picture by the action of light, and it is my purpose to instruct you; if you obey my advice and follow my directions you will soon acquire that knowledge. I wish you to be interested in each stage of the process of taking a photograph, so that you may be able to explain to any intelligent person the various steps as you proceed.

The first important fact I wish to impress on your mind is, that in taking a photograph you are executing a series of delicate chemical experiments. If these are carefully performed, a successful photograph will be produced; but if, from carelessness or ignorance, any portions are badly executed, the final result will be correspondingly unsuccessful.

You must therefore cultivate the habit of carefully observing all your operations; you must be exact in measuring and weighing your various chemicals, until you have experience enough to know the amount of variation that judgment will permit. You must also be very careful in using only clean vessels to hold the different solutions; the

cleanliness that is ordinarily considered sufficient will rarely do for chemistry.

The word Photography means drawing, engraving, or writing by Light.

You are, doubtless, aware that white light—light from the sun, for instance—is composed of several different colours, of which Yellow, Red, and Blue, are the most marked; it also possesses three distinct properties—Illuminating, Heating, and Chemical powers. These three powers are singularly connected with these three colours. The Illuminating property exists mainly in the Yellow rays—the Heating property in the Red—and the Chemical in the Blue or Violet rays.

With the illuminating power you are daily familiar; the July sun gives proof of its Heating power; and it is your present purpose to learn that all photography is based on its Chemical power.

For the full explanation of these facts I must refer you to Hunt's "Researches on Light."

Strictly speaking, then, it is not light—the illuminating agency—that is the cause of Photographic action, but an active principle associated with it, and which is connected chiefly with the weakest illuminating rays, and with some that are even invisible. This photographic power is termed Actinism.

The general term photography embraces many processes, but the particular method I am going to teach you is called the "Collodion Process," because collodion plays an important part; this substance is a glutinous fluid formed by dissolving gun-cotton in a mixture of Ether and Alcohol.

The photographs taken by the collodion process may be

either Positives or Negatives. The meaning of these terms will be fully explained when I describe the manner of taking them.

APPARATUS AND CHEMICALS NECESSARY.

The first thing required is to obtain a set of Apparatus. Beginners too frequently get a cheap one, and are surrounded with unnecessary difficulties from this cause alone. There is no reason that the apparatus should be very expensive, but each article should be good of its kind. The quantity you will require will depend on the branch to which you devote yourself. Should you wish to be equally well furnished for producing Portraits and Landscapes, a full equipment will be necessary. The following comprises a complete set, equally adapted for all purposes, together with a list of Chemicals. Should there be more articles enumerated than you think you will require, you must consult with some photographic friend, or explain to the person from whom you make your purchase the description and size of pictures you wish to take, and you will be advised what articles to omit.

10.---	A "Rectilinear" Lens for landscape and architecture.	10x8 - 8 1/2, 6	
10.---	A well-made accordion-body Landscape Camera.	X 9.---	7.15.
1.6.-	A light, strong, but portable Tripod Stand for ditto.	8.2.-	6.6.-
1.10.-	A travelling Glass Bath with water-tight top.	1.5.-	1.---
2.2	A portable Dark Tent, for working in the open air.	2, 2	2.2
	A Portrait Lens, fitted with Central Diaphragms.		
	A substantial square Mahogany Camera for in-door work.		
	A strong, well-made Camera Stand for in-door work.		
2.---	A strong Iron Head-rest for standing figures.	2, 2	

f22.9.- f19 .1.-

12 APPARATUS AND CHEMICALS NECESSARY.

- 16.18. - 1
- 0.18. - Three Plate Boxes, to suit the sizes of the Camera.
- 15.8 Patent Plate-Glasses to fill the above.
A Corundum File.
3. - A set of Scales and Weights, with Glass Pans.
- 4.6 1 Plate-cleaning Holder.
- 10.6 1 or more stout Oak Printing-frames.
1 Pneumatic Plate-holder for large plates.
- 4.6. 2 or more Porcelain Dishes.
5. - 1 Ebonite Tray, to be used for "fixing" only.
3. - 1 large and one small Glass Funnel.
- 2.8 1 Ebonite Funnel, medium size.
- 4.10 1 each 20 oz., 5 oz., 2 oz., and 60 minim Graduated Glass Measure.
- 1.6 1 4 oz. tall Graduated Collodion Bottle.
3. - 1 Diamond for cutting glass plates.
1 Silver-bath Meter, for estimating the strength of silver solutions for printing.
A few Glass Stirring Rods.
Linen Cloths and clean Chamois Leather.
A few wide and narrow-mouthed Bottles.
4. - A black velvet Focussing Cloth, about one yard square. 230.18.2
20 oz. Bromo-iodized Negative Collodion.
20 oz. Positive Collodion.
5 oz. Recrystallized Nitrate of Silver.
1 oz. Iodide of Potassium.
1 oz. Pyrogallie Acid.
1 oz. Citric Acid.
1 lb. Protosulphate of Iron.
4 oz. Nitrate of Potash.
1 oz. Nitrate of Baryta.
5 lb. Hyposulphite of Soda.

- 15 grs. Chloride of Gold.
- 4 oz. Kaolin.
- 4 oz. Cyanide Potassium.
- 5 oz. Glacial Acetic Acid.
- 5 oz. Methylated Alcohol.
- 1 bottle Crystal Varnish.
- 1 ditto Spirit do.
- 4 oz. Acetate of Soda.
- 1 oz. Bicarbonate do.
- 1 bottle Black Varnish.
- 1 ditto Plate-cleaning Solution.
- 1 quire Albumenized Paper.
- 1 ditto white Blotting Paper.
- 1 book Litmus Paper.
- 1 packet of large round Filter Papers.
- 1 ditto small.

It is not necessary to get the chemicals in exactly the quantities stated, and for sizes below $8\frac{1}{2}$ by $6\frac{1}{2}$ in. smaller portions will do; yet it is not well to begin with too small a stock, as you will be apt to spill and waste a quantity at first; and if you reside in a country district you may experience a difficulty in obtaining articles sufficiently pure for your use. It is better to buy them of those persons who supply photographic materials, from whom you will obtain them cheaper and better than from local chemists and druggists.

Having selected your Apparatus and Chemicals, the next thing is to prepare a room in which to conduct your principal operations. This is technically called a dark room, though (except in a chemical sense) there is no reason that it should be very dark.

HOW TO PREPARE THE DARK ROOM.

MANY persons imagine that any cupboard or out-of-the-way corner will do to prepare plates in; this is a mistake, and if you can select a room sufficiently large in which you can move about freely, it will be much better than being cooped up and crippled in your actions. Moreover, in warm weather, the fumes from the chemicals will be injurious to your health if the chamber be too small and ill-ventilated. All articles that can be spared should be removed from the room, and none allowed to remain that can be injured by chemicals being spilt upon them. It should be kept very clean, for dust and dirt are great enemies to good photography. Oilcloth or bare boards are best for the floor, not carpet. A convenient range of shelves should be made round the room, and some hooks provided for hanging cloths and towels on.

You will remember I explained that the Actinic force that accompanies Light resides mainly in the blue, and but little in the yellow and red rays; photographers ingeniously take advantage of this fact by illuminating their "dark" rooms with these non-photographic lights, and they thus see how to prepare their sensitive plates.

Every aperture and chink that admits white light must be carefully stopped up. If there be more windows than one, they should be blocked out, and the remaining one be covered with three folds of deep orange-coloured calico; or a hinged frame should be made to cover the window, glazed with glass of a dark orange or a ruby red colour, so that you can have orange or white light in your room at will. Specially prepared coloured glass of this kind is

to be obtained from the Photographic dealers. If a window is not obtainable, a gas light, a lamp, or even a candle may be used, if a deep yellow glass be provided. An ordinary moderator lamp, with a yellow paper screen over it, makes a very fair light for the *dark* room. Persons usually make the room for preparing their plates too dark. This is a mistake; at least sufficient light should be admitted to enable you to see what you do, but it is important that this light be quite a dark orange yellow. Should you commit the error of admitting too much light, your pictures will be imperfect; you will find under the head of "Defects, Failures, and Remedies," on page 51, the proper method of proceeding in such a case.

Near the window or lamp, a strong shelf or table should be placed, on which to place the bottles you will require; and closely at hand you must have a supply of water. If you have the water laid on, with regular tap and sink, your arrangements will be perfect; failing this, you may have a cask or other vessel with a tap in it, filling it up with water as you need; or, on an emergency, use a jug, and a pail to receive your slops. Have a towel and soap conveniently placed to wash your hands with.

Be sure and provide some effective means for ventilating this room. When you are not at work, let the door and window be freely open, so as to encourage draughts of air through. In winter this room should be heated by a fire or stove; as the photographic chemicals never work properly at a low temperature. Do not use a gas stove for this purpose, unless it be one of the improved form, where the products of combustion are carried out of the room, for, next to a charcoal stove, an ordinary gas one is the most

poisonous and dangerous means that can be employed to warm an apartment, and especially a photographic dark room.

HOW TO BEGIN WORK.

Your apparatus being secured, and your room prepared, you are now ready to make a commencement, and probably you will desire to make your first attempt in photography by taking a portrait.

But as you are a beginner, you should commence with the easiest thing, and to take a good portrait is one of the most difficult things in photography. The proper proceeding will be to set up a plaster cast, an engraving, a porcelain statuette, or some similar still-life object, and to practise upon it, being prepared for many failures arising from your ignorance and clumsiness, before you attempt portraiture. You should try picture after picture, noticing carefully the faults you commit in one, so as to avoid them in the next.

In this way, by patience, observation, and practice, you will speedily gain such experience as will make your new occupation a pleasure. Above all things, do not expect to produce good pictures all at once; and be not discouraged with failures, but try to understand why you fail.

In setting up an inanimate object to copy, the risks of failure are less than when you have a person to sit, for the object will not move nor alter its expression, nor make remarks if you do not succeed. But when brother Tom, or friend Harry, is called in, the case will be different; they will be full of fun and jokes, will most likely move at the critical moment, and say disparaging things when they find

the picture a failure. All this will confuse you, and cause you to omit things you ought to have done, and do abundance of things you ought not to have done, and dishearten you in your early progress.

You had better, therefore, set up a plaster cast bust—one painted stone-colour will be best—such as those of Shakespeare, which are so abundant, and, using this as model, work frequently at it until you have sufficient mastery of your instrument and materials to produce, with moderate certainty, a passably good picture; then you may proceed to portraiture.

Place your object in a good light; a glass house built for the purpose is the best; but this you may not at present be able to obtain. Should you have it in your power to erect a proper photographic studio, you will find on page 70 ample directions. Your early experiments may be made in a garden or a greenhouse, or a well-lighted apartment will suit, if you use a white screen—a sheet thrown over a clothes-horse will do—to reflect light upon the shaded side. A background may be formed by hanging some quiet drapery a little distance behind your object.

Place your plaster bust, or similar object, in a good ordinary light, and so arranged that a slight shade falls on one side, which will permit the modelling to be seen. Now get your portrait lens, and after wiping carefully the surfaces of the glasses with a clean silk handkerchief or chamois leather, screw it on to your portrait camera, and place them both on your heavy camera-stand opposite to your object. The ground glass of your camera should have the sizes of the glass plates marked on it in squares, corresponding to the position the glasses will hold when they

are placed in the plate-holder of your camera. Place your stand and camera so that the lens is opposite to about the centre of your plaster bust, and move the stand and camera backwards or forwards until the image of the object is of the size, and occupies the place on your ground-glass that you wish the image to do on the plate you are going to use, remarking that the nearer the camera is to the object, the larger the image will be, and *vice versa*. Lay the black velvet focussing-cloth on the camera; put your head under the cloth, and you will then more clearly see the image on the ground-glass. Slide the inner body of a camera in or out, until the image is seen quite distinctly, then fix the camera with the screw provided. While your head is still under the focussing cloth, pass your hand round to the lens, and move the rack backwards and forwards till you find the point at which the image is most distinct.* It is then said to be "in focus," or "sharp."

HOW TO PRODUCE GLASS POSITIVES.

THE photographs that I shall first instruct you to produce are called "glass positives." At one time they were considerably in favour, but portraits on paper are now preferred. The production of a portrait on paper involves a double process, first making the *negative*, and then printing from it on to paper. Glass positives are the easiest, the quickest, and the cheapest to produce of any kind of

* These instructions for adjusting the focus apply to the common camera. The best kind of camera is provided with an endless screw arrangement, or a rack and pinion, by which the adjustment is made more easily and perfectly by moving the camera instead of moving the lens.

photograph. As the manipulations are so similar, the practice of producing them affords the shortest and surest introduction to the knowledge how to take *negatives*; and as the final result is so quickly seen, they suit the enthusiastic ardour of the beginner.

The chemicals required for this process are—

Positive collodion.

Nitrate of silver solution.

Plate-cleaning do.

Developing do.

Fixing do.

Crystal varnish.

Black do.

The “positive collodion” you will purchase ready prepared. When required for use, pour carefully three or four ounces into the tall collodion bottle; and when you have done for the day, return what remains back into the stock-bottle, that it may settle. In this manner you can always use from a clear quantity, and avoid those spots and defects which arise from a turbid or unsettled collodion.

The nitrate of silver solution is one of the highest importance. To know how much solution to mix, fill your bath with water to within an inch of the top, and measure how much it holds. Suppose it to contain 25 fluid ounces; * as 35 grains of nitrate of silver to one fluid ounce of distilled

* It is important to notice that in all photographic formulæ, where ounces of fluid are named, *fluid* ounces are meant, and that the glass measures are graduated for the purpose. When solids are named, *Apothecaries* weight is meant. But the materials are sold to you by *Avoirdupois* weight; and as the ounce of the latter is not so heavy as that of the former, this fact must be carefully remembered, or disputes with shopkeepers, and errors in mixing your solutions, will arise. The Apothe-

water is the proper strength, 2 ounces of nitrate of silver will be required to form 25 fluid ounces of the necessary solution. Dissolve the silver in 4 ounces of distilled water or boiled rain-water, then add 4 grains of iodide of potassium to it, shake it well for a few minutes, and add 21 ounces more of distilled water.

The solution will now be a pale milky colour, and will require filtering. Should it not run through quite clear, it must be re-filtered. Add one drop of pure nitric acid to every ounce of nitrate solution, and then it will be ready for use.

DEVELOPING SOLUTION FOR POSITIVES.

Protosulphate of iron	...	...	...	150 grains
Nitrate of potash	...	...	...	100 „
Glacial acetic acid	...	...	...	$\frac{1}{2}$ ounce
Water	...	...	...	10 ounces
Nitric acid	...	...	...	5 minims
Alcohol	...	...	...	$\frac{1}{2}$ ounce

Dissolve the crystals, and if the solution be not quite clear, filter it, then add the alcohol and acids. It will keep good until it is a deep brown colour, when it ought to be rejected.

FIXING SOLUTION FOR POSITIVES.

Cyanide of potassium	...	...	...	60 grains
Water	...	...	...	6 ounces

Dissolve, and it is ready for use.

carries ounce weighs 480 grains, and the ounce Avoirdupois but $437\frac{1}{2}$ grains. It is better, therefore, in mixing nitrate of silver solutions, to estimate the quantity required in *grains*, remembering that the purchased ounce of nitrate of silver will never contain more than $437\frac{1}{2}$.

Let each of these solutions be distinctly labelled, and cork the bottles when they are out of use. The fixing solution should be legibly marked "Poison," to prevent accidents. It should be particularly kept out of reach of children, being a most deadly poison, despite its rather attractive smell.

The crystal and black varnishes that will be required when we finish the picture you can purchase ready for use. When these solutions have been prepared, your next business is to learn

HOW TO CLEAN THE GLASS.

The description of glass known as "Flatted Crown" is well suited for positives, but, before using, it requires carefully cleaning. The sharp edges should be first removed with a "corundum" file, or by drawing the sharp edge of one piece over the sharp edge of another; then lay the glass on a clean flat surface, or put it in a "plate-cleaning holder," and pour a few drops of the "plate-cleaning solution" in the middle. Rub it carefully over every part with a bit of clean soft rag: turn the glass over, and do the other side the same. Then polish each side with a clean cloth, and finish with a soft chamois leather kept expressly for this purpose. Now breathe on the glass; and if the breath deposits evenly, the plate is clean. If the plate, however, shows patches and marks, it must be re-cleaned. Let the edges be carefully wiped, and the plate is ready for use.

The following preparation makes a good plate-cleaning solution for glasses that require mechanical friction to make them clean;—ordinary water 5 ozs., alcohol 5 ozs., iodide

of potassium 15 grains, iodine 3 grains. When dissolved, add tripoli, prepared chalk, whiting, or rotten-stone, in sufficient quantity to make a creamy paste. This thin pasty solution is to be rubbed on the plates on both surfaces, and polished off as already described. This amount of cleaning will, generally, be sufficient for new glasses, but when they have been used they require more labour. They must then be well washed under the tap, to get rid of all collodion and chemicals, and be wiped on cloths kept expressly for the purpose. Should the plates have been varnished, they must be soaked for some hours in a saturated solution of washing soda, till the varnish and film come freely off. The glasses must then be immersed for a few minutes in a solution composed of common nitric acid 2 ozs., water 10 ozs., and be well washed and treated as already described. It is a good plan, when working, to have a dish of water at hand, and to place the spoilt pictures in it at once while they are wet, and at the end of the day to wash the glasses and put them away clean. By thus not allowing the films to dry on the glasses, they are much easier cleaned, and fewer failures will arise from dirty glasses.

Collodion is a good material for cleaning glasses when they are not very dirty. Pour a few drops on the glass, and well rub it with a clean cloth, and you will entirely remove all grease. A hint may thus be taken how to use up waste collodion.

The glass plate being cleaned—and it is a good plan to clean a dozen or so in advance—it is ready to receive the collodion. Remove the stopper from the bottle, and wipe from the lip any dust or dry film adhering; and, holding the plate horizontally by one corner with the thumb and

finger of the left hand, pour steadily into the middle of the plate as much collodion as will half cover it. Then gradually incline the plate so that the collodion flows to each upper corner, not allowing it quite to touch the thumb, nor to flow a second time to any part; then steadily pour back the excess from one of the lower corners into the bottle, and while the plate rests on the mouth of the bottle, move the plate backwards and forwards with a rocking motion to prevent the collodion setting in crapy lines. Perform this operation coolly and steadily, and try to avoid spilling any of the collodion. A little practice will make it easy. You must now shut your door and window, and see that only the orange light illuminates the room. When the collodion is *set*—usually in a few seconds—the plate is ready to be immersed in the nitrate of silver bath. To know how long to keep the plate before putting it into the bath is a point that you will learn by experience; but it depends on many circumstances, such as the nature of the collodion and the temperature; but this rule will guide you: if you put the plate in too soon, streaks and marks will be formed, commencing from where it first touched the silver solution; if you do not immerse it soon enough, the end of the plate that has become too dry will be insensitive, and will show a transparent mark. By noticing these points you can judge whether you have made an error in placing the collodionized plate too soon or too late into the nitrate of silver solution. The plate must remain in the bath in summer time about three minutes, and in winter from five to ten.

The collodion being set, now lift the dipper up, and place the back of your plate on it—it will adhere by capillary

attraction—and immerse plate and dipper into the bath solution with one steady dip, and continue to agitate the plate by moving it about in the bath for a few seconds. Take care it does not slip off the dipper. If there be the least hesitation or stoppage while the plate is being immersed, there will be a line marked across the plate.

While the plate is in the bath you must get ready your dark slide, and see that there are no dirty corners nor dust in it. Lift the plate up and down in the bath several times by means of the dipper, and the agitation of the solution will remove the oily-looking lines on the surface. Allow it to remain in the bath till all apparent greasiness is removed, and the film has become creamy-looking. Then take it off the dipper, and, handling it as carefully as possible—chiefly by the corner uncollodionized—let it drain for a few seconds on clean blotting-paper, and wipe the adhering solution off the back of the plate with a pad of blotting-paper; then lay it, collodion side downwards, into your dark slide, the silver wire corners supporting it by the four corners. Close up your dark slide, and your plate is ready for use.

You may now return to your plaster bust, and removing the ground-glass frame from the camera, insert the dark slide in the place. Cover the lens with the cap, raise the shutter of the dark-slide, and gently remove the lens cap, so as not to shake the camera: thus the light will be admitted through the lens to the sensitive plate. Experience can alone determine the length of the “exposure.” The brilliancy of the light, colour of object, kind of lens, nature of collodion, time of day, and even the period of the year, are all modifying circumstances.

Suppose you allow ten seconds. Count the time exactly, and replace the cap on the lens. Next shut down the shutter of the slide, remove it from the camera, and take it into the dark room. Close the door, and noticing that no white light is admitted, remove the plate carefully from the dark-slide. The nitrate solution that has accumulated at the bottom of the plate, drain off with clean blotting-paper. Put about an ounce of developing solution into a clean measure glass, and holding the plate horizontally by the bare corner, collodion side upwards, pour steadily but quickly along the edge of the plate that was uppermost in the dark slide, sufficient to easily cover it; gently incline the plate to allow the developing solution to flow uniformly backwarks and forwards. Watch the "coming out" or "development" of the image. The image will quickly appear; first the parts most strongly lighted will show themselves, next the shaded portions, and when these are fully out, turn off the solution, and wash the plate well, by allowing the water to flow over it until the greasy lines disappear.

Lay the plate in a shallow dish kept for the purpose, and pour quickly over it sufficient of the fixing solution to cover it. Directly the yellow film of iodide of silver is dissolved, the plate must be lifted out and well washed. When the plate goes into the fixing solution, white light may freely be admitted. The fixing solution must be put back into its bottle, and may be used so long as it retains the power to dissolve the yellow film.

If the exposure be correct, and you have developed properly, you will now have a nice picture of your bust.*

* If the picture be not perfect, refer to the chapter on "Defects, Failures, and Remedies," page 60, for further instructions.

Your plate may be dried spontaneously or by heat. When dry, pour black varnish on the *glass* side, just as you did the collodion, and drain off at one corner, taking care it does not flow over to the face of the picture; or, better and easier, use a black varnish made expressly for the purpose, which is to be laid on with a brush, and which dries quickly, or may be assisted with heat. The collodion surface now requires varnishing, to protect it from atmospheric action. Remove carefully with a camel hair brush any dust or dirt on the picture, and pour crystal varnish over it as you did the collodion. Drain it, and when dry, your picture is finished and ready to be mounted.

You have now passed through the various operations, and it only requires practice and observation to make them familiar to you. Having obtained this practice, the bust may be removed, and a friend being placed in its stead, you may produce a portrait by applying the same manipulations. Let him sit in an easy, graceful position, and, if necessary, steady his head by the use of the head-rest. Let him look at some dark object, and allow him to wink his eyes freely during the sitting, but caution him to be quite steady in all other respects.

You have to put all this information into practice, and you will understand how to take *glass positives*.

HOW TO TAKE "FERROTYPES."

A FERROTYPE is a photograph produced in all respects by the same means and in the same manner as a glass positive, except that instead of using a glass plate to support the collodion film, a thin plate of black varnished iron is employed. The plate, being opaque, does not need a black

backing. They are not liable to break like glass, but in all other respects they are the same kind of photograph as a Glass Positive.

HOW TO TAKE NEGATIVES.

You must clearly understand the difference between a Negative and a Glass Positive. Every glass picture, to a certain extent, partakes of the nature of both; but a "glass positive" is a picture done at one operation, and complete in itself; whilst a Negative is not so much a picture as the means of producing one.

Glass positives are examined by reflected light, negatives by transmitted light; the one you hold *down* to look *at*, the other you hold *up* to look *through*; the positives show natural objects as they are—lights for lights and darks for darks; the negatives just the reverse—faces, hands, and linen very dark, and black drapery quite clear. Hold a picture of each kind up to the light and look *through* them; the positive will appear thin and transparent, the negative dense and opaque. In other words, a negative is a glass picture produced by somewhat similar means to a positive, only that in the "development," a much thicker and denser deposit is formed.

The negative is to the photographer what the types are to the printer; and as the latter are arranged just the contrary of the impression that is taken from them, so must the photographer's negatives—his types—be the reverse of his prints. The analogy between the two processes is so considerable, that the production of paper pictures by the aid of negatives is always termed "printing."

It will be of great assistance to you if you can obtain from some photographer a negative that you can keep by

you, to compare with your own, until you have acquired experience to know how to judge for yourself.

The same apparatus serves for the production of negatives as positives, but some of the chemicals are different; those that you require are—

Bromo-iodized negative collodion.

Nitrate of silver bath solution.

Developing do.

Intensifying do.

Fixing do.

Spirit varnish do.

The *bromo-iodized negative collodion* is rather different in its preparation to positive collodion, and is better adapted for giving dense pictures. It is often supplied as plain collodion and iodizing solution. When so supplied it is made ready for use by mixing three parts by measure of the plain collodion to one of the iodizing solution. It is better to add the iodizing solution to the collodion a few hours before using, to allow time for floating particles to subside.

Nitrate of Silver Bath Solution.—The same solution of nitrate of silver that you have used for positives will not do for negatives, but you must make another solution which you must keep exclusively for negatives.

I strongly recommend you to use a bath that will hold a larger quantity of this solution than is merely necessary to cover your plates. The greater the quantity of this solution that you have in use, the longer it will keep in good order, and the more satisfactorily it will work. Select, therefore, the largest vessel that convenience will permit,

and make up enough solution to fill it, according to the following directions:—

NEGATIVE NITRATE BATH.

Recrystallized nitrate of silver ...	1 oz. avoirdupois
Nitrate of baryta... ..	40 grains
Iodide of potassium	1 grain
Distilled or boiled rain water ...	12 ounce
Glacial acetic acid	2 minims

Keep strictly to these proportions, whatever quantity of bath solution you determine to make up. Dissolve the proper proportion of nitrate of silver in one quarter of the quantity of the water required; in one ounce of the remaining water dissolve the iodide of potassium, and in the remaining quantity of water dissolve the nitrate of baryta. When these three solutions are formed, add that containing the iodide of potassium to the silver solution, and agitate well; finally, add these united solutions to the one containing the nitrate of baryta.

It is a good plan to place the solution, without filtering, in a white glass bottle in open daylight, sunshine if possible, for as long a time as you can spare. When required for use let it be filtered, and then add the glacial acetic acid. When the solution is out of use, let it be kept where it is constantly exposed to light.

DEVELOPING SOLUTION FOR NEGATIVES.

Protosulphate of iron	150 grains
Glacial acetic acid	$\frac{1}{2}$ ounce
Alcohol	$\frac{1}{2}$ „
Distilled water	10 ounces

This solution gradually acquires a sherry colour, but its quality remains equally good. It should be filtered before using.

FIXING SOLUTION FOR NEGATIVES.

Hyposulphite of soda	...	...	5 ounces
Water	...	...	5 „

This solution may be used until it loses its power of dissolving the yellow iodide out of the film. It soon becomes discoloured, but that is of no consequence.

“Patent Plate” is the best description of glass to use for negatives. It requires the same careful cleaning as for positives. As it is more difficult to produce clean negatives than positives, you had better accustom yourself to use a glass one size larger than you require your picture to be, so that the defects, which more frequently occur on the margin of the plate, may not spoil your picture.

Pour the collodion on the plate, sensitize, drain, and place it in the dark slide carefully, and according to the same directions as given for glass positives.

The same difficulty occurs with negatives, in giving any rule for the length of exposure in the camera, as in positives; the appearance of the plate during development is a useful guide, but negatives usually require three times as long exposure in the camera as positives. Be very careful, when your plate is in the dark slide, to keep it erect, and to handle it gently. Never knock the dark slide against anything, or the plate will be covered with abundance of spots from particles of dust and dirt falling on it.

You may experiment on your plaster bust for producing

your first negatives, as you did for your glass positives, or, if you have experience enough, you may attempt a portrait. During the exposure proceed the same as for a positive, making the requisite increased allowance of time for a negative. When in the dark room, take the plate out as carefully as before, and remove, with clean blotting-paper, the nitrate solution that has accumulated at the bottom; and, holding it by the corner, pour over it the developing solution, and in a few seconds the image will appear. After a little experience you will be able to judge, by the manner in which the image makes its appearance, whether you have given the proper exposure in the camera.

If it start out at once, directly the developer has flowed over the plate, the exposure has been too long; but if the image comes out slowly and reluctantly, and you have difficulty in making the deepest shades appear, it has not been exposed long enough.

The happy medium between these two is the correct time. When this has been given, the image makes its appearance steadily and gradually—first the high lights, next the light shades, and finally the deep shadows. Suppose it a portrait of a gentleman—the shirt-front, face, and hands are first seen; the light folds of the drapery next show themselves; and lastly, the details in the darkest parts. If it were a glass positive you were producing, you would have poured the developer off before these last were seen; but, being a negative, you must carry the development on until the whole of the details are clearly out, then pour the solution off the plate, and wash it well. By holding your plate up to the light and looking *through* it, you will see the image as a negative—the whites all dark, and dark portions

nearly transparent; and if the picture appears in proper harmony, making allowance for reversed effects, the lighter portions being nearly opaque, and the darker parts very clear—but *the whole picture full of gradations and half-tones, with scarcely any parts entirely opaque, and very few clear glass*—then the development is complete; if, however, the picture presents somewhat this appearance, but is deficient in opacity of deposit, or “density,” it must be “intensified.” To do this, pour over the plate as much as will comfortably cover it of the following—

NEGATIVE INTENSIFYING SOLUTION.

Pyrogallie acid	...	...	...	3 grains
Citric	„	...	...	1 grain
Glacial acetic acid	...	...	...	$\frac{1}{2}$ drachm
Distilled water	...	...	...	1 ounce

When this solution has thoroughly mixed with the water on the plate, pour it back into the measure-glass, and add a few drops of nitrate of silver solution to it (10 grains to the ounce of water), mix, and pour again over the plate; the image will speedily begin to intensify—that is, the silver will be deposited over the various parts where the light has acted. This intensifying must be continued until the parts of the negative most lighted have the requisite opacity.

This solution sometimes becomes turbid and muddy before the picture is dense enough. In such a case, pour away, and renew with some fresh intensifying solution and silver, and proceed as before. This may be repeated many times, if needed, until the required effect is produced. Here is, perhaps, the most difficult thing you have to learn—to know how far to go, and when to stop; how to gain

intensity enough to produce a vigorous negative, and yet to avoid making it too dense, and losing half-tone. As a rule, beginners over-develop their positives, and under-develop their negatives.

But it is possible to intensify too much, and make the picture so dense that you cannot print through it. You must watch the kind of prints that different negatives produce, and when you find one that gives a brilliant yet soft image—for the real test of a negative is the kind of print it produces—study that negative well, observe the degree of opacity it has, and, keeping it as a standard, try and produce all others like it. In this way you can train and educate yourself to produce good negatives.

The development and intensifying being finished, wash the plate and lay it in the ebonite dish; pour the fixing solution over, and when the yellow iodide is dissolved out, give it a careful and copious washing; for if any of the hyposulphite of soda remain in the film, it will crystallize and spoil it.

Your picture now being washed, you may calmly examine it in ordinary daylight. If it appear as a moderately good but over-exposed positive, with a yellowish pearly tint, and, on looking through it, show abundance of half-tones, both in the opaque and transparent parts, you may consider you have a correctly-exposed and well-developed negative, and one from which you may anticipate brilliant prints.

If, however, the negative appear as a good positive, with brilliant blacks, but rather chalky whites, and, on looking through, if these whites are very dense without half-tone, and the blacks almost like bare glass, then your negative is defective, and will only produce a hard black and white

print; the fault being that it was not long enough exposed in the camera.

Should it, however, appear as a very much over-exposed positive, the whole plate having a grey film over it, obscuring the image, and on looking *through*, the details of the shadows are almost as intense as the white linen, and the whole picture is deficient in contrast, then it has been over-exposed.

The two instances I have pointed out are extreme ones; it is your object to avoid each; but of the two errors, under-exposure is the worst; by careful printing you may get a passable proof from an over-exposed negative, but no dexterity will avail with an under-exposed one, and, unfortunately, beginners' negatives, from their great desire to "work quick," have too frequently this latter fault.

I have now to call your attention to the last thing you have to do to complete your negative; viz., the varnishing.

HOW TO VARNISH THE NEGATIVE.

AFTER the plate has been well washed and dried, it is ready to varnish. If only a few prints are wanted, you may use crystal varnish. If, however, you value your negative, and purpose producing many prints from it, the crystal varnish will not give sufficient protection, and you must use a spirit varnish, which will produce a much harder surface. To use this spirit varnish, warm the dried negative before a fire uniformly all over nearly as hot as the back of the hand will bear, then pour the varnish on like collodion; let the varnish remain horizontally on the plate a few seconds that it may soak into the film, then drain off, and dry it with heat. The proper degree of heat to use will be acquired

by a little experience; if the plate be made too hot, the varnish will not flow uniformly over, but will run dry and into irregular streaks. If it be not hot enough, the surface will dry dull and dead. With the medium heat the film will dry with a hard, glassy surface. When cold your negative is complete, and is ready to be printed from.

HOW TO PRINT ON ALBUMENIZED AND PLAIN PAPER.

THE remark has been made, that a *negative* is not so much a picture as the means of producing one; and your next proceeding is to use the negative to produce an impression on paper. This operation is called "printing," and the paper picture produced is termed a "print." There are two kinds of paper employed, plain and albumenised. The former yields a dull surface, like an engraving, and is chiefly used for pictures that have to be coloured; the latter has a glazed surface, and is the kind in general use for almost every kind of photography, as it gives a more brilliant picture, and yields finer definition.

It is scarcely possible to over-estimate the value of good printing. A good print is an adequate reward for much time and labour. Good printing depends on many things; and the first step towards obtaining a fine print is to get a good negative; this secured, it is surprising how many of your troubles will be removed.

The apparatus and materials necessary for printing are—

Printing-frames.

Porcelain dishes.

Horn or box-pincers.

American pegs.

Albumenized paper.

Plain salted do.

Nitrate of silver solution.

Litmus paper.

Kaolin.

Chloride of gold.

Acetate of soda.

Hyposulphite of soda.

Albumenized Paper.—This material is troublesome to prepare, and you can purchase it ready for use much better than you can make it for yourself. There are two principal kinds, known as *Rive* and *Saxe*. The former is a French paper, and has the highest glaze and finest surface; but the latter, a German one, is the most uniform in its general texture.

Plain Paper.—Plain paper requires preparing, or “salting,” before being ready for use, or it may be purchased already salted. It is not a difficult thing to “salt” your own paper. Procure some sheets of plain Saxe paper, and immerse them for five minutes, removing air-bubbles, in the following solution:—

Chloride of ammonium	...	...	100 grains
Chloride of barium	...	...	100 „
Citrate of soda	...	...	20 „
Water	...	...	20 „

Hang the sheets up to dry, and they are ready for the next operation. This may be performed in ordinary daylight.

A very simple method of using paper as “plain”—that is, without glaze—is to employ the usual albumenized paper, but, instead of using the glazed or albumenized side, to sen-

sitize the back or plain side of the paper. No salting will be required, as sufficient is already in the paper with the albumen. Many samples of imperfect albumenized paper yield good plain prints, which are useless if the albumen surface is employed. The albumen helps to produce a much richer picture than is usually to be obtained on plain paper.

Nitrate of Silver Solution.—Whether you intend to print on plain or albumenized paper, you must make a fresh silver solution, as those used for positives or negatives are not adapted for printing; neither will the one you are about to make serve the former purposes; they must be kept for their separate uses. Measure how much fluid one of your porcelain dishes contains when filled half an inch high, and make so many ounces of plain nitrate of silver solution, 40 grains to the ounce. The crystals have simply to be dissolved, and the solution is ready to be tested. Place a piece of blue litmus paper in it, and, if it turn red, ammonia must be added until the blue colour returns. At each time of using the solution it must be tested, and it must never be used unless it allows the litmus paper to retain its blue colour. This solution may become discoloured by use, but if you adopt the plan of keeping some of the white powder called Kaolin, an ounce or two, in the bottle in which you pour your solution after using, you will not be annoyed with your paper becoming darkened by the brown solution. Shake up the kaolin with the silver solution, and in subsiding the kaolin will carry down with it the colouring matter, leaving the silver solution clear. This solution rapidly loses its strength by being used—that is, the sheets of paper during the act of being sensi-

tized rob the solution of much of its silver. Therefore each day you must observe if the silver solution is sufficiently strong. Some albumenized papers require a stronger silver solution than others, but, unless you are advised otherwise, you will be quite safe in using one of 40 grains to the ounce. The "Argentometer," or silver bath tester, is a useful instrument to test the strength of your solution. Each time before using, immerse the Argentometer into it, and note the figure on the tube where the surface of the fluid touches, and it will indicate, with sufficient accuracy for practical purposes, the number of grains of nitrate of silver in each ounce of the solution. Thus if it stand at 30, 40, or 60, each ounce may be considered to contain so many grains of nitrate of silver. It is not sufficient that you originally mix your solution 40 grains to the ounce, but it must be continued so; and until you have experience you will scarcely believe how quickly the act of sensitizing the paper abstracts the silver. If you adhere to the use of this little instrument it will keep you right, but never forget that unless your silver solution is kept to its proper strength you cannot obtain brilliant and vigorous prints. I should mention here that the Argentometer, though very useful for estimating the strength of the printing silver bath, is not applicable to the negative bath.

Chloride of Gold.—This valuable substance is generally sold in bottles or tubes containing 15 grains. It is very deliquescent, and, unless hermetically sealed, can only be kept in solution. Break your tube, and dissolve the contents in a bottle containing five ounces of water, and label it accordingly.

Hyposulphite of Soda.—Dissolve two ounces in sixteen

ounces of water, and label the solution. Make a fresh quantity for every batch of prints.

HOW TO SENSITIZE THE PAPER.

As the prepared paper for printing is not nearly so sensitive to light as the sensitized positive and negative glass, there is not the same precaution necessary to perform the operations in so subdued a light; yet the presence of a strong white light is to be avoided. No more paper should be prepared than is required for the day's use, as it quickly spoils.

Fill your dish to the depth of not less than half an inch with the nitrate of silver solution. Cut your paper to convenient sizes suitable to your negatives, and lay it on its glazed or albumenized side downwards on the surface of the silver solution; if it is plain paper, lay it on the smoothest side. Hold the sheet by two opposite corners diagonally, so that the centre is the lowest, and allow this centre to rest first on the solution; then drop each corner. By this means the sheet can be easily laid on the solution without risk of the fluid getting on to the back, which would cause stains. When it has lain for about half a minute, lift up one corner with the pincers, and if there are any air-bubbles, remove them; replace the sheet, and allow it to remain two minutes on the solution, then lift it off, and draw the face of the paper over the edge of the dish, so as to cause the solution adhering to the surface to be wiped off and flow back into the dish. Then have ready a clean sheet of blotting-paper, and lay the wet sheet face downwards on the blotting-paper. This will still further

remove the silver solution, and will permit the sheet to dry with a uniformly sensitive surface. Thick blotting-paper should be used, and, if kept clean, will answer several times. Suspend the albumenized paper with an American peg to a line, in a closet, or other dark place, away from the light, where it can dry spontaneously. It is then ready for use.* Your paper ready, place your negative in the printing-frame, collodion side uppermost—be sure the glass is quite clean—and lay the paper on it, prepared surface downwards; put a few sheets of blotting-paper behind it; next put the hinged back in its place, and secure the whole tightly with the springs or other fastenings provided.

It is essential that the paper should be in very close contact with the negative to produce a “sharp” print, and you must observe that this pressure is uniform, to prevent breaking the negative.

Expose the frame to the full daylight, but not to sunshine, and allow it to remain until the paper is printed. How long this operation will take depends on the power of the light and the density of the negative. In summer, a very short period is sufficient, say from ten minutes to half an hour; and in winter, an hour, or even a whole day, may be required. To know how the print is proceeding, undo the fastenings *on one side of the frame only*; and by lifting up half of the hinged back, you can, without disturbing the position of the negative and paper, examine the latter, and

* It is right to mention that albumenized paper already sensitized can be purchased of the photographic dealers at as economical a price as the pupil can prepare it himself, and the paper so purchased will “keep” much longer than when prepared in the usual manner.

observe its progress. First, the general outline is marked ; then the deep shadows ; next the lighter shades ; and finally, the delicate half-tones. By these latter you must be guided. You must print till they are not only clearly out, but a few shades deeper than you would like them, because in the subsequent operations they will become lighter, and unless you make this allowance your print, when finished, will not be deep enough. A little experience will tell you how dark you should print. In printing portraits, you must judge entirely by the *head* ; get out all the half-tones clear and distinct, so that the ultimate picture shall show the features nice and round, not buried in black shade from being over-printed, nor pale and flat from under-printing, but just such soft gradations as will make a pleasing likeness. When the proper depth is obtained, take it out of the printing-frame, and it is ready to be *toned* and *fixed*.

HOW TO TONE THE PRINTS.

IF you are producing several prints, you may wait till they are all ready, keeping those first done in a drawer or other place secluded from light ; they should be toned and fixed the same day they are printed, for although these operations may be deferred, the results are seldom so good. When ready, immerse them in a dish of clean water, removing air-bubbles, and move them about that the water may get freely between ; allow them to remain five minutes ; pour the water away, and refill the dish, and again wash for another five minutes, moving them about as before ; change the water a third time ; this last time the water should only

be slightly milky ; if it is more than this, the prints must be further washed.

It is unfortunate that the print cannot be preserved with all the bloom and richness of colour that it shows when in the printing-frame. Very much of this beauty is destroyed in the act of "fixing" the photograph. To compensate for this loss, the print is passed through a process called "toning;" this consists in depositing a thin layer of gold on the silver image, whereby the print is made both more lasting and more beautiful. There are several toning solutions, but I recommend the following :—

TONING BATH.

Chloride of gold	...	...	...	$7\frac{1}{2}$ grains
Acetate of soda	...	...	...	$\frac{1}{2}$ ounce
Distilled water	...	...	...	40 ounces

The bath may be mixed in the above quantity, as it will keep for a considerable time. It should be prepared a day or two before being used. When required for use, pour enough in a dish to well cover the prints. Take the prints from the last washing water, and immerse them one at a time; keep them moving about, and remove air-bubbles. Until you acquire experience, you had better not have more than three or four prints in at a time. They must be closely watched, for they speedily change from their reddish-brown to a purple tint; and if they have been printed deeply enough, the shades will pass to a purple-black, while the whites will assume a delicate rosy hue. Some little experience is required to know when to take them out, but you may be guided by the general appearance as seen by looking *through* them, holding them up to the

light. If they are purple when thus examined, they may be removed into a dish of clean water, to remain until they are all toned and ready to be fixed.

According to the depth to which you have printed, and the length of time they have been in the toning solution, so will the colour be. If you wish a rich chestnut brown, a very little toning will suffice; if you like a purple-brown, tone deeper; and if a dark purple-black, you must print and tone very deep. The colour of your prints will materially depend on your negatives. With a well-defined, soft, yet vigorous negative, you may produce any tone; but from weak or hard negatives you cannot produce good pictures. Prints kept too long in the toning solution become of a cold grey colour, and have a weak and flat appearance.

If you are attentive you will quickly learn how to get, with good negatives, almost any desirable tone by modifying the depth of printing and strength of toning. The time usually occupied in toning a print is from two to five minutes. The preceding instructions are mainly directed to highly albumenized prints; a little modification is required for plain paper proofs; they should be printed rather darker, as they have a greater tendency to bleach during toning, and the toning solution should be more dilute.

The prints must not be toned in broad daylight, nor in deep yellow light, for in the latter the shade of colour would not be seen. A weak shaded white light is the best. When the toning bath is new and strong, but few prints should be kept in at a time, and they must all be kept constantly turned over and moved about, so that they do not lie over each other, or get air-bubbles between them, and

thus get unequally toned. In cold weather it is better for the toning solution to be used warm; it will then tone much quicker. A useful plan is to fill a dish with hot water, and let the vessel holding the toning solution stand in it. The colour given by the gold must not only be on the surface, but must be seen when looked through as a transparency. Unless it is toned thus far, it will probably lose its rich colour in the next stage of "fixing." Most prints lose some of their tone in fixing, and allowance for it should therefore be made by carrying the toning a little further; but how much further is a matter for experience to determine, according to all circumstances of the moment. Some prints tone much more readily than others; some require to be carried further, according to the subject. When some are toned they may be taken out and placed in a dish of water, and fresh untuned ones may be put in until all are toned. They can then, unless too large a batch, be all fixed at one operation. The dish of water into which the toned prints are put to wait until they are fixed should have some common salt put into it, the quantity not important, so that it has a distinct taste. Unless this precaution be taken, the prints will go on toning; for when they are lifted out of the bath, they are saturated with toning solution. But this salt solution instantly arrests the toning action. The prints may safely be left here till the toning is completed for the day, and all are then ready for fixing.

When a glass positive or a negative is developed, there is seen to be a portion of the yellow iodide of silver remaining that has been unacted upon by light. This is removed by "fixing." In like manner, in forming a paper print,

there is left a portion of the chloride of silver that is unacted on by light, and which must be removed; if it were not, the print would turn dark all over when exposed to light. This operation is called "fixing" the print. There is this important difference, however, between the print and the negative: in the negative you can judge by the change of colour when all the unacted-on iodide of silver is removed; but in the print the unacted-on chloride of silver is of the same colour as the whites of the paper. You cannot, therefore, judge by any change of colour when your print is fixed.

HOW TO FIX THE PRINTS.

It is a good plan to keep special dishes for toning and fixing, especially the latter, as the hyposulphite spoils all gold and silver solutions. Pour your fixing solution into your ebonite or other dish specially reserved, and immerse your prints; immediately separate them individually, and keep moving them about, so that the solution may get freely to them all. The prints will quickly change, and lose some part of the beautiful hue they had in the gold solution, but this tint will be restored when they are finally finished.

The temperature of the fixing solution is a matter of consequence. When it is very cold, the hyposulphite materially loses its solvent action. Hyposulphite of soda in the act of dissolving deprives the water of much of its heat. Thus the solution of hyposulphite is found to be much colder than the water that was used to dissolve the crystals. It is better, therefore, in cold weather, to use warm water. The

feel of the solution to the hands will always be a good test for its temperature. It should always be such as to be agreeable to the hands. It need never be warmer, but it should not be used when it feels cold. The crystals should be entirely dissolved before the prints are immersed. As much solution should be made as to allow the prints to be moved freely about in it. Not too many prints should be put in at once, and when they are in they should be separated from each other as quickly as possible, to allow the hyposulphite to act. If the prints are allowed to adhere to each other, and air-bubbles to form between them, no end of trouble will be experienced, and the prints will probably be spoilt. All the prints should be got in as soon as possible after each other. Ten minutes will be sufficient time to allow them to remain in. They must be kept moving about and separated from each other the whole of the time. They may then be taken out and put in a large vessel of water, and the same process of separation repeated, so that the prints may as quickly as possible get rid of the hypo. When they are all separated and freely floating about, the water must be changed, and for the first half-hour the water must be renewed every few minutes, so as to remove the hyposulphite solution which the prints are saturated with. This is the stage at which the most effectual washing can be done. The prints should be kept in running water, and, if your circumstances will permit, should be kept in for six hours, and then dried. If you cannot give them the advantage of a running stream, change the water in which they are soaked every half-hour for the first three hours; then soak them all night, and next morning give them two or three changes, and let them

be dried. This well washing is the only security to prevent your prints from fading, for more are spoilt from neglect of this important but irksome part of the process than from any other cause.

HOW TO MOUNT THE PRINTS.

WHEN dry, the prints may be very curly; but if ironed on the back with a clean, warm, flat iron, they will lie smooth, and then they may be cut and trimmed as taste dictates.

Hot thin glue may be used to mount them on cardboard; but starch, such as used for household purposes, and about the same consistency, is equally adapted. It should be used cold. To complete them, they should be sent to the hot-pressers, who, for a very small charge, will glaze them by rolling, which communicates a highly-finished appearance.

HOW TO BECOME A SUCCESSFUL PHOTOGRAPHER.

MY WORTHY PUPIL,—In the preceding instructions I have been as clear and as simple as I could, and have avoided explanations that, in your early progress, might embarrass you. That you may be successful is my ardent wish; yet, as there is no royal road to photography, it is probable that you may be beset with troubles common to the practice of the art.

It may be a melancholy satisfaction to know that the cleverest practitioners are subject to them as well as the less skilful; the difference, however, being, that the former,

by perseverance, overcome them, while the latter become beaten.

If there were no difficulties to be surmounted, there would be no credit in excellence, and one of the stimulants to advancement would be denied to the students of photography. The difficulties, however, that constantly arise, afford sufficient opportunity for the exercise of ingenuity, intelligence, and patience. It is enough to say, that if you meet with but few difficulties, deem yourself fortunate; and if you encounter many, be not discouraged, but strive to overcome them.

Generally speaking, to point out the origin of a defect is also to suggest a remedy. It is impossible to anticipate in what your difficulties will consist, for the experience of no two exactly agrees; but you must endeavour to *understand* the process, and to grasp the *spirit* of the directions. Above all things, resolve to be neat and clean in your manipulations, cool in your manner, and exercise an observing eye; by these means you will certainly escape from nine out of ten of the beginner's troubles.

Whether a person shall succeed or fail in photography depends very much on the spirit with which he commences. If he think the whole process a *mechanical* one—mainly a question of apparatus, baths, and developers—he has no pleasant future. When such a man gets into difficulty—which he soon does—he is apt to declare that his chemicals are bad, that his bath is out of order, that his camera is wrong; he is ready to blame anything and everything rather than his own defective manipulation, instead of calmly endeavouring to find out in what his trouble con-

sists. Possibly he may have mixed his plain collodion and iodizing solution in reversed proportions, or strengthened his nitrate bath out of the unlabelled hypo. bottle, or may have tried to develop with his cyanide. Such a man soon wears himself out ; declares "it's no use trying, it's all chance ;" and attributes the success of skilful men to the use of "secret dodges."

As a contrast, let us observe another kind of man, who, getting into trouble, thinks it probable that it is himself that may be wrong, and not the chemicals ; and, instead of throwing them down the sink, perseveringly proceeds, finally discovering that the same chemicals that formerly gave him bad pictures, now furnish good ones, the difference being *only in the mode of using them*. A man of this stamp, taking pride in his new acquisition, and not blind to his own deficiencies, reads the Photographic Journals, joins a Photographic Society if he can, compares notes with others who practise the art, keenly enjoys a visit to a Photographic Exhibition, and speedily becomes an intelligent and clever manipulator.

Although it is not possible to point out all the sources of failure you may experience, yet those most commonly met with will be described. When you are trying to discover a cause of failure, it is important, in making changes of apparatus or chemicals, to change only one thing at a time, otherwise you may never know for certain the exact cause of your trouble. Some men never appear to care to know *why* they fail ; they go on and on, always hoping for the best, and are rarely quite successful, for as soon as they are clear of one difficulty, another besets them.

ON THE EVIL OF DIRT.

THERE is no one thing in particular that I so strongly advise, as a preventive of failures in photography, as scrupulous cleanliness. Everything used should be clean. Clean negatives can only be obtained on clean glasses. Dirt causes smears, stains, streaks, comets, and fog. It is not only necessary to have the collodionized side of the glass clean, but also the other side, otherwise dirt is carried into the nitrate bath, and will put it out of order. Dirty dark slides cause dirty corners of negatives; dirty cameras permit dusty spots on the negative film. Dusty lenses give dim definition, and require longer exposure. Dirty developing glasses cause muddy precipitates; dirty filter papers contaminate the solutions that pass through them; and dirty bottles and measure glasses spoil the materials they contain. But the worst description of dirt is dirty hands. No matter how clean or pure things are, dirty hands can spoil everything. They are constantly ready to communicate their infection. Some men's hands are always dirty from heat and perspiration, and many are so from carelessness and indolence. Dirty sweaty hands are constant sources of photographic trouble, for they more or less contaminate everything they come in contact with.

Dirt is happily described as "matter in the wrong place;" dirt must, therefore, be hostile to successful photography, which consists in having matter in the right place. Although not scientifically correct, yet for practical purposes I may describe dirt as mechanical and chemical. By mechanical dirt I mean that which adheres to the surface of objects from atmospheric action, or from imperfect washing, or dirty

water. Chemical dirt consists in the remains left on glass, in bottles, and in measure glasses, of former materials employed, and which decompose and alter the nature of the fresh materials used afterwards.

Inferior photographers are often dirty and slovenly in all their manipulations and arrangements; some good operators are careless, but their success arises from their general ability, to which their slovenliness is a decided drawback. Most successful photographers are, however, in all essential particulars, scrupulously clean.

I dwell on this value of cleanliness because I know that by attention to it you will avoid many causes of failure. Besides, what is the use of my giving advice how to extricate yourself from your troubles if you carry at your finger ends the constant means of creating new ones?

The general instructions previously given have, in the main, been on the assumption that your manipulations were successfully accomplished; experience teaches, however, that failure may occur at every turn. To complete our task, then, we must devote attention to these failures—to photography under difficulties, photography out of sorts, photography ill, sick, knocked up, and confined to the hospital. Like a skilful physician, I must describe the various ailments, and the means of effecting a cure.

DEFECTS, FAILURES, AND REMEDIES.

“Humanum est errare.”

MANY defects are more or less of a minor character, and though endeavours should be made to remove every imperfection, yet, and especially at the commencement, this may

not be possible. There is one cause of failure that a beginner often encounters, that may hinder if it does not entirely stop his career. It is that terrible one known technically as "Fog." It is important at the outset to know how to conquer this difficulty. With this view the following ample directions are given.

ON THE CAUSES OF "FOG," AND HOW TO DISCOVER THEM.

"Fog" is a defect that arises from many causes; it consists of a *darkening of the film all over, directly the developing solution is applied*. It may occur only in a small degree, slightly obscuring the shadows of the picture, or it may exist to so great an extent as to prevent the appearance of the image. Sometimes deleterious vapours are the reason; as, the dark room being built over a stable, and filled with reeking vapour; the room being newly painted with a slow-drying paint; a leakage of gas; a bottle of ammonia with a badly fitting cork or stopper. A remedy for any of the above is simply to remove the cause.

In extremely warm weather the developing solution is much more energetic, and fogging may thus arise from this increased energy: remedy, dilute the developer with water one-half, or add double the quantity of acid. The following are, however, the most usual causes of fogging:—

Alkalinity of nitrate bath: remedy, addition of nitric or acetic acid till litmus paper is *slightly* reddened.

Extreme acidity of nitrate bath: remedy, addition of oxide of silver or ammonia until litmus paper is only slightly reddened.

Omission of acetic acid in the developer, or not sufficient acid introduced: remedy, add the acid, or increase the quantity.

Over-exposure in the camera: remedy, give shorter exposure, or insert a smaller sized diaphragm in the lens.

Diffused light in the dark-room. If yellow calico be used, it has perhaps become bleached, and must be replenished; or additional folds must be used. Sometimes chinks of unsuspected white light are the causes; if so, they must be stopped up.

Diffused light in the camera or the dark slide, admitted through a joint giving way, or an old screw-hole, or the parts of the camera not fitting: remedy obvious.

Nitrate bath made with impure silver, or bad water: remedy, add a few drops of saturated solution of bicarbonate of soda until the bath solution remains turbid after shaking; then boil it or expose it to the sun for a few hours, and filter; then add acid until the image is clear in the shadows.

Newly mixed collodion will sometimes cause fogging; it then requires to be kept for a few days, when it may work clean; or it may be mixed with some older collodion, and may then be all right. Collodion should always have a sherry-colour to work without fog. When it is nearly or quite colourless, this golden colour can be communicated by the addition of an old sample that is of a deep brown colour; or if no such old collodion be at hand, a few drops of tincture of iodine may be added till the collodion acquires the colour; or a grain or so of iodine may be added direct to the collodion, in which it will rapidly dissolve. If none of these aids are sufficient, then the collodion must be rejected.

If the fog occurs at the same time that you make any change—such as having a new camera, fresh nitrate of silver

bath solution, a new quantity of developer, or another sample of collodion—you may be able at once to suspect and perhaps detect the cause of fog; for if some change occurs in the nature of the pictures which did not exist before, it is very probable that this fresh circumstance is directly connected with the changed character of the pictures. Therefore, whatever it is that has been newly introduced should be carefully examined, and very probably the cause of the fogging may be discovered. When, however, you have no such clue, you must adopt a systematic method for its discovery. The following is a certain means of finding out the cause:—

First, examine your dark room, by covering your yellow window with some material that entirely excludes *all light*. Crevices and cracks admitting white light may then be seen that before were unnoticed, and through some of these light may have shone on the glass during its preparation, and caused fog. If such be found they must be stopped up, and if these have been the causes your annoyance will be over.

If these be not the cause, you must next suspect the window, for though it may admit only yellow light, it may not be yellow enough. Yellow materials become bleached, and require renewing, especially yellow calico. To test your window—and it is very important that you be quite certain on this point—proceed as follows: collodionize a plate as usual, and immerse it in the bath; then cover up your yellow window entirely, or leave only the smallest possible chink, so that you can but just see what to do. Take your plate out of the bath, and put it in the dark slide. Now remove the temporary covering from the yellow window,

and draw up the shutter of the dark slide *half-way*, to expose *one half of the plate*; keep the plate to the light of the window for (say) five minutes, then replace the shutter, cover up the window with the temporary covering as before, so as to exclude the yellow light, and proceed to develop your plate. Keep the developing solution on about the usual time that is required to produce a picture, for you will not be able to see what is going on: then wash and fix it. Now restore the light and examine the plate, and it will present one of the three following appearances:—The half exposed to the window will be drab, and the half not exposed be quite clear and transparent; let us call this case A. Or it will have a drab deposit—in other words, fog—all over it; we will call this case B. Or the plate may be perfectly clear and transparent all over; let this be case C. As the plate *must* have one of these three appearances, by following up the investigation some definite information will certainly be obtained.

We shall examine each of these cases in succession. Case A shows that the yellow window is at fault, for the half of the plate exposed to it is fogged, but the other half is clear; therefore sufficient chemical light passes through the window to injure the plate. The yellow covering, if bleached, must be removed, or more coverings must be supplied, and a plate must be tried after each addition, until you have your window so yellow that a plate may be exposed five minutes without being fogged. Yellow glass sometimes allows light enough to pass through to fog the plate; such glass should be removed, and a better sample put in its place. I have seen a piece of yellow-brownish glass, though very dark in colour, that admitted actinic light almost as freely as white glass. This is rare, but in photography you must try all

things, and only hold fast to that which is good. If the window be discovered to be the cause of your trouble, it must be covered with fresh calico, tammy, silk, paper, glass, or other yellow material; or it may be painted yellow; but in some manner the light must pass through a yellow screen in such a way that, while you are permitted to see your manipulations, your plate must remain without fog. You must have no rest till this is accomplished. This done, your fogging trouble is over, and you may proceed to work in comfort; for Case A clearly showed the window was the cause of the fog.

It should be borne in mind, however, that the amount of protection that a yellow window gives to sensitive plates depends upon the quantity of light that falls upon the window. Plates may be fogged upon a day of sunshine, and yet be perfect on a dull day. A yellow window, with a western aspect, may suit a morning light, and yet cause fog in the afternoon. When the window of the developing room is thus exposed to a variable light, it should be provided with an additional movable yellow curtain, to be used when a stronger light than usual falls on the window.

If the cause of fogging has thus been satisfactorily traced and cured, it will form an excellent lesson. But as there are other causes of fogging than an imperfect yellow window, let us examine the plate as shown in Case B.

Case B.—The plate darkens all over under the action of the developer, and you can distinguish no difference between the two halves: this shows that your window is quite right, because the half of the plate *not* exposed to the light from the window is as much fogged as the half that was exposed. This experiment also shows that it is nothing external to

the room that has caused the fog, for the plate has never been out of the room. It *must* therefore arise from something in the room, and if it be neither stray white light nor injurious fumes, it will lie between the bath, the collodion, and the developer. First, try the bath; test it with a strip of reddened litmus paper, and if it change to blue the bath is alkaline, and an alkaline bath is a common cause of fogging. Add acid, drop by drop, testing between each addition, until blue litmus paper is *very* slightly reddened. Again try a plate; the fogging will probably not be quite gone, but much reduced: add a little more acid until it entirely disappears.

Suppose, however, that the reddened litmus paper did not change colour, then test with blue litmus, and if it turn *very* red, carefully neutralize with oxide of silver, or ammonia, until only a slight acidity remains; then resume your trial to see if you have expelled your enemy, for excess of acid, especially nitric, will occasionally cause fog. Should the test-papers show that the bath is neither very acid nor alkaline, the probability is that the error is in the developer or the collodion.

Make up, carefully, a fresh developing solution, being particular not to omit the full proportion of acetic acid. You may even increase the quantity of acid, for some samples are weak, and you may happen to have one: the developing solution, unless it have its proper addition of acid, will always cause fog. If the new developing solution rid you of your difficulty, that will show that the cause of fog was in the developer; if, however, the fogging still remains, you must suspect your collodion. Some collodions cause fog, therefore get some fresh, and let it have a distinct colour—a

dark golden, for instance—for colourless collodions are more prone to fog than coloured ones. If you are not now relieved, you may assume that the nitrate bath is the defaulter, for it must be one of the three. Make up a new bath, and if you use good silver and clean water, you are almost certain to be out of your trouble.

In this way, by carefully and exhaustively examining one thing at a time, you will be certain to trace out the delinquent material. If you have decided that the nitrate bath, for instance, is the cause, then, if it be a new one, you have to find out whether the sample of nitrate of silver is pure, or whether the water is the cause. The latter is frequently an unsuspected source of trouble. Again, if it be found that the developer is at fault, supposing it to be correctly mixed, each of its components may be suspected and examined in turn—the iron, the water, the acetic acid, and the alcohol. Some samples of methylated alcohol often cause great annoyance by impurity.

To return to our examination: supposing that we have not yet discovered the cause of our fog; the conditions of Cases A or B not applying, let us examine Case C.

In Case C the plate develops perfectly clean and transparent all over: this shows not only that the yellow window is all right, but that the chemicals are right also; in fact, that the origin of the fog must be *external* to the dark room; and, as nothing else but diffused light can now be the cause, we must seek to discover it. First examine the dark slide well; in some unsuspected manner it may admit light to the plate.

If your dark slide be found perfect, next examine your camera carefully. You may test it in this manner: pre-

pare a sensitive plate as usual, and place it in the camera, in its usual situation, as if you were going to take a picture; put the cap on the lens, draw up *half-way* *only* the shutter of the dark slide, but do not uncover the lens. Let the plate remain thus for a full minute, then develop and fix the plate. The plate will either be one-half fogged, or it will be quite clear all over. If half be fogged, it shows that the camera admits light in some other manner than through the lens, and thus the fog is caused. To know where the light is admitted, remove the ground-glass; and, excluding all light with the focussing cloth, put your head into the camera (the lens being still covered), and you will see the light streaming in. You may examine the interior of your camera in another manner. Place the dark slide in its place, with a plain glass plate in it, and draw up the shutter; remove the lens, and with the aid of the focussing cloth again examine the interior through the flange aperture. If any stray light be admitted, you will see it reflected from the face of the plate. It is necessary, when thus examining the interior of a camera, to wait for a few minutes, to allow the eye to get accustomed to the darkness, or you may deceive yourself, and think there is no light, from your momentary inability to perceive it. Supposing that you have found the light streaming through cracks, crevices, or holes, they must be stopped up; and the cause of your fog being discovered and removed, your trouble is over.

Should your plate, however, develop clear all over, it will show that the interior of the camera is perfect. Another cause of fog may arise from the lens itself. If a strong light fall on it, particularly sunshine, fog will certainly be

produced. A screen or shade should be provided, so that no light falls on the lens, except from the objects that are being delineated. Occasionally there is reflection from the sides of the lens tube, or the edges of the back lens. Dead-black varnish will be the remedy in these cases.

If you have not now traced out the difficulty, having run through your chemicals and apparatus, it is most probably caused by over-exposure. It is scarcely probable, however, that you could pursue this inquiry without already having a clue to the real cause. I have gone through this series of exhaustive experiments to show that by this method of inquiry you may succeed in tracing not only fog, but almost any other trouble, to its true source.

DEFECTS IN GLASS POSITIVES AND FERROTYPES.

The light parts are pale and misty, and what should be the dark parts are drab-colour. Over-exposure produces this effect; reduce the time in the camera, or place a smaller diaphragm in the lens, to cause it to work slower. If this treatment does not remove the mistiness, it may be produced by some of the causes of "fog," the remedies for which have been previously stated.

The blacks are very deep and brilliant, but deficient of detail, and the lights rather dark.—The exposure in camera has not been sufficient, or the developing solution has been poured off too soon.

The collodion film is full of honeycomb-like markings; the film has transparent, crapy, diagonal lines, especially where the deposit is greatest.—These defects arise from inferior collodion: procure some of better quality.

Opaque white marks and streaks at the end of the plate where

the collodion was poured off.—Keep the plate a longer time before you immerse it in the bath; if this does not prevent the markings, add plain *un-iodized* collodion to the usual collodion in sufficient quantity to cause the markings to disappear.

Transparent insensitive mark at the opposite end to where the collodion was poured off.—The plate was kept too long out of the bath, and the upper part has become dry; the plate must be immersed sooner into the bath.

The picture, after washing off the cyanide solution, has blue stains.—The developing solution has not been sufficiently washed away before the fixing solution was used.

The shadows of the picture are clear, but the light parts are chalky, and deficient in half-tone.—The developing solution has been kept on too long.

The picture is brilliant when wet, but on drying becomes dull, the shadows being misty blue instead of bright black.—Bad collodion is the cause of this defect.

DEFECTS IN NEGATIVES.

The picture very intense where the light has acted most, and nearly transparent in the shadows.—The plate is under-exposed and over-developed.

The shadows have nearly as dense a deposit as the high-lights.—The plate is over-exposed.

The image will not intensify under the action of the pyrogallie acid and silver solution.—There are many causes for this defect, and you must discriminate which is the most probable in your own case, and act accordingly. Bad collodion—inferior nitrate of silver—too much acid, especially nitric, in your nitrate bath—the exposure, too long or too short, in

the camera—the absence of sufficient nitrate of silver solution on the film or in the developing solution—cold and dark weather—deficiency of light—too small a stop used with long focus lens.

The film floats off or breaks away from the glass during development or subsequent washing.—Defect in the collodion; too much acid in the nitrate bath; plate immersed in bath too soon, or kept out too long. A complete remedy for this is to albuminize the plate before coating it with collodion.

Transparent spots.—Causes: particles suspended in the collodion; allow the collodion to settle, and do not use it to the bottom of the bottle. An ingenious Collodion Filter is sold at the shops for filtering collodion from insoluble particles. Transparent spots may also be caused by particles floating in the nitrate bath and adhering to the surface of the film while the plate is being sensitized: remedy, filter the bath. These spots may also be caused by the dark slide falling, or receiving a knock while the plate is in it, and particles of dirt falling from the interior of the dark slide on the film. Transparent as well as opaque spots arise from a dusty atmosphere and from grit that may fall from the walls and ceiling of the dark-room: remedy, clean the walls and ceiling, but if their surfaces are in a loose gritty state it will be necessary to paper them.

Extremely fine transparent spots in enormous quantities, technically known as “pinholes,” are caused by the nitrate bath becoming overcharged with iodide of silver: remedy, dilute the bath with an equal bulk of distilled water, which will cause a dense precipitate of iodide of silver; filter, and

add sufficient nitrate of silver crystals to restore the bath to its proper strength. It is better to add the bath solution slowly to the distilled water than to add the water to the bath solution, as a denser precipitate of the iodide of silver is thus produced. A more complete cure is effected by the addition of 4 grains of nitrate of baryta to each ounce of the silver solution, and if the bath is originally made up with this addition to it, as given on page 29, the annoyance will never occur.

Opaque spots.—Causes : developer not filtered ; dust falling on the plate while being coated ; dirt, and dried fragments of collodion from lip of collodion bottle ; dust and dirt from dark slide, or from the other sources which cause transparent spots.

Streaky lines in the direction of the dip.—These are often caused, in a new bath, by deficiency of acid ; in an old one, by the accumulation of ether and alcohol. Remedy : in the first case, add acid cautiously till the streaks disappear ; in the second, mix with it an equal bulk of fresh 35-grain solution of nitrate of silver, or, better still, make up a new bath.

A frequent remedy for these streaks is to gently agitate the plate directly it is placed in the bath, and to keep it moving for twenty or thirty seconds afterwards.

There are many other causes for these “streaks in the direction of the dip ;” they nearly always arise from either the collodion or the bath, and they often arise from a want of harmony between the two, for the same bath will give them with one collodion and not with another. Sometimes they are caused by the collodion containing too much iodizing solution for the strength of the bath. The remedy then

is to decrease the strength of the collodion by the addition to it of some plain uniodized collodion, or by adding five or ten grains of nitrate of silver to each ounce of the bath solution. Occasionally these streaks are due to the collodion being too horny and repellant; the remedy then is to add from two to five drops of water to each ounce of collodion. This makes the collodion more porous, and allows the ether and alcohol to mix more freely with the bath solution.

When a much-worked nitrate bath is allowed to stand unused for some hours it will frequently throw up a metallic scum, which, floating on the solution, causes streaks and other markings: remedy, wipe off the scum with blotting-paper, or change the bath for a fresh one.

Sharp horizontal lines across the plate.—These are caused by hesitation in dipping the plate into the bath.

Collodion film mottled and thick.—The collodion requires diluting with a little plain ether.

The collodion film, on drying, peels off the glass.—This is often due to inferior collodion; but the most usual cause is dirty glasses. It will arise also from pushing the development too much in cases of under-exposure; also from intensifying weak images by bichloride of mercury or other intensifiers.

When the film in drying is observed to split, which it generally does at the edges, a solution of gum water, weak albumen, thin gelatine, common beer, or any adhesive fluid, should be flowed over the plate. This, in drying, cements the film on the glass and prevents further splitting. It may happen that a film that has dried properly will, on commencing to heat it, prior to varnishing, begin to split or

peel; in that case pour the varnish on at once, even though the plate be cold, and continue the varnishing; the plate will dry with a dead surface, but if adroitly and quickly done, the film will be saved. A second varnishing with heat will restore the proper glazed surface. Sometimes, in drying a wet plate, the film will begin to split as it dries; in this desperate instance do not hesitate to pour the spirit varnish at once on the wet surface, and put the plate aside to dry spontaneously. When dry the film thus preserved will present a curious appearance, covered with a white powder, the resin precipitated by the water from the spirit varnish. The plate may then be heated, and re-varnished with spirit varnish, when the surface will be restored to its right state, and betray little or no evidence of the unusual treatment that it has received, and the negative will be saved.

Markings like curtains and fringes.—When these do not occur from bad manipulation—and be careful not too hastily to decide—these faults may arise from the collodion or the bath, and the best remedy is to endeavour to obtain samples that will work without thus plaguing you. When a strong iron developer is used, it is important that you have the proper quantity of alcohol in it, as this causes the solution to flow easily and smoothly over the plate, and allows the developing solution readily to combine with the silver solution which is on the film. When the developer flows in irregular greasy lines, there are sure to be abundance of stains from this alone.

The formation of crystals and tree-like markings under the film when dry.—The hyposulphite solution not washed away enough. Sometimes this will show immediately;

at other times it may be days or weeks before being seen.

Irregular smears and stains.—Dirty glasses are the most usual cause; also lifting the plate out of the nitrate bath too soon; placing it in the dark slide before the greasy lines have disappeared; not draining sufficiently, and the solution accumulating at the bottom; from dirty and wet plate-holders in the dark slide; handling the plate with dirty hands; the developing solution not flowing uniformly; pouring the developer principally on one spot; plate immersed in bath too soon, or not soon enough; developing glass not clean.

DEFECTS IN PAPER PRINTS.

The paper does not print equally all over: has marbled or mottled spots.—The silver solution is too weak, or the paper has not been floated a sufficient time.

The print, when finished, has a disagreeable yellow tint, and, on looking through, yellowish-brown opaque patches are seen.—The print is not fixed; the hyposulphite is too weak, or has been in use too long, or the print has not been immersed long enough to dissolve the chloride of silver.

The whites and blacks are very brilliant, but a deficiency of detail in both.—The negative is at fault; it is under-exposed.

The prints are weak, and have a cold and slaty colour.—Under-printing and over-toning are the general causes. The hyposulphite solution may be too strong. Over-exposed negatives produce weak prints, deficient in proper contrast.

The prints are grey, and have a mealy appearance.—Over-toning and defective paper; sensitizing solution too weak or too acid.

Red spots, streaks, and markings.—Defects in the paper, or the albumenizing, or both.

Prints will not readily tone, but remain of a brown, leathery hue.—Toning bath too alkaline; chloride of gold deficient in strength; the toning-bath exhausted; the paper kept too long before being printed on, or, after being printed, kept too long before toning.

Metallic smears, spots, stains, finger-marks, &c.—These defects nearly always arise from bad manipulation, such as handling the paper with dirty fingers, allowing solutions to splash, putting the paper on a dirty table, dust and dirt in the printing-frame, or on the pads used in the latter, or similar causes; or they may occur from bad paper.

GENERAL ADVICE TO THE PUPIL.

THE proposed course of instruction in the collodion process is now completed; practice is only required to make you perfect, and to render the practice of the art a source of pleasure or profit.

From the progress you may be presumed to have made, there will be no need to continue the homely and familiar style in which the instruction has been hitherto conveyed, and the remainder of the information will be given in a more condensed form.

Your attention is invited, however, to the following maxims and axioms, by attention to which you will save

much valuable time and materials, and render the practice of the Art more interesting and profitable :—

MAXIMS AND AXIOMS.

CONCENTRATE your attention on the production of a good clean negative; a professional printer may be employed to produce your prints.

Never expect the faults of your negative to be corrected in the printing; a good print can never be produced from a bad negative.

Take pride in cleaning the glasses well; stains and smears always indicate slovenliness and inattention.

Whenever you take a negative, take as good a one as you possibly can, even though it be a bad subject; almost anything looks well in a first-rate photograph; moreover, it is excellent practice.

Never be contented with a medium quality of picture if you can obtain a better one; "I daresay it will do!" will not do at all in good photography.

Obtain the most perfect apparatus that your means afford, and take pride in keeping them clean and in good order.

Before using your lenses, wipe them with a soft chamois leather, and dust out the interior of your camera with a damp cloth.

Wipe your dark slide dry after each plate; the accumulation of nitrate of silver at the bottom corners of the dark slide stains the plate, rots the wood, and denotes the careless operator.

Frequently re-varnish the interior of your dark slide where the sensitive plate rests.

Carry your dark slide in a cloth when taking it from place to place (especially out of doors), and cover the top of the slide with it while the plate is being exposed.

Keep your camera exactly level when perpendicular objects are to be taken; nothing is so abominable as to see distorted representations. This especially applies to architecture; when buildings are made to appear falling forward, or leaning backward, or vertical lines are crooked and twisted, they always betray mismanagement of the camera.

Get all parts of the picture into focus if you can; if you cannot, then make the principal objects the sharpest—in a portrait, the eye; in a group, the central figures; in a landscape, the foreground, in preference to distant objects.

Keep your nitrate bath covered, to exclude dirt and dust, and your bottles well corked and stoppered, as well as distinctly labelled.

Wash your developing-glass after each time of using.

Keep a separate vessel for every solution, and a separate bottle and funnel for each distinct purpose; let them all be distinctly labelled. Much time and trouble in cleaning dishes and bottles will be saved, and no end of uncertainty removed.

Never open a bottle of collodion, ether, alcohol, or varnish near a flame, or an explosion may take place.

Never allow the sun to shine on the lens when taking a picture.

Never attempt landscapes on windy or misty days.

Under-exposure is the unpardonable sin of photography, because it is irredeemable.

Aim at good pictures rather than quick ones.

There is more certainty in working a slow than a quick process.

Learn one process thoroughly, so as to be able to depend on it; then, and not till then, amuse and instruct yourself by practising others.

Use plenty of water everywhere; hypo left in your negatives will cause them to crack; hypo left in your prints will cause them to fade.

HOW TO CONSTRUCT A GOOD GLASS-ROOM.

To have a well-constructed glass-room is a matter of vital importance as well to the amateur as to the professional photographer, but especially to the latter. Such a room ought to permit the sitter to be properly and quickly lighted, so that good portraits can be taken with expedition. It should be adapted for working in dull weather as well as bright, and the sitter should be able to have either side of the face taken without turning the eyes to the light. The room should be well ventilated, so as not to be too warm in summer, but sufficiently so in winter; and no fumes of chemicals should be present. Many of these desirable conditions will depend on the size and aspect of the room.

During the last few years glass-rooms have been built in every variety of form; but, after a fair trial, practical men are satisfied that an oblong room, with a ridge roof, is the best. Local necessities will often dictate the size, shape, and aspect of a room; when, however, the photographer can have control, the writer believes that a room built as he is about to describe will be found to be the most perfect

that present knowledge can suggest. If circumstances permit, the room should be built on the ground floor. It should be oblong in form, the length running from east to west, so that one of the long sides should have a clear north aspect. Its length should not be less than 25 feet, and need not be more than 40 feet. The width may be 16 feet, but must not be less than 10 feet. Although called a "glass" room, it should be all built of substantial brick-work, except the side facing the north and half of the roof on the same side; two-thirds of these should be of glass. The south side of the roof should be slated, and the whole building should, if possible, on that side be built against a wall much higher than itself, so as to screen it from the sun at midday. Buildings, trees, or other objects should protect the ends from the morning and afternoon sunshine. A room built in this manner will be lighted only from the north, and will have the most uniform and soft light that it is possible to obtain. If these natural advantages cannot be obtained, strong substantial screens should be erected on the roof to prevent the sun shining into the room. Undisturbed by sunshine, morning, noon, and afternoon, the light will be so steady and uniform that the photographer will be able to produce his negatives with almost absolute certainty.

Suppose a medium of the sizes referred to be adopted—say 32 feet long by 12 feet wide—a handsome apartment will be formed, large enough to take a group, and to contain the apparatus and furniture of a well-appointed studio. The sides up to the eaves of the roof should not be more than 7 feet, and need not be so much; the height to the ridge should be in proportion, from 10 to 12 feet high.

This will give a good slope to the roof, helping to keep the glass clean, and to prevent leakage, to which fault flatter roofs are very subject. The glass should not go to the ends of the room, but about 6 feet of each side should be bricked up, and the roof should be slated at each end about 6 feet also. If the room be 32 feet long, this will yield about 20 feet length of side and top light, all of which should have opaque blinds. As it is not advisable at any time to use more light than is necessary to illuminate the sitter, not more than half the light provided should be used at one time. A background should be placed at each end of the room, and at whichever end the sitter is placed, the blinds should be opened on that side only; the darkened portion of the room will be pleasant for the sitter to look into, and useful to place the camera in. When the sitter is taken at the other end, everything must be reversed. As the majority of portraits are best taken with three-quarter face, and as a pleasanter expression and definition of the eyes are secured when they are allowed to look away from the light, these desirable conditions are entirely secured by this arrangement of light. The side of the room should be papered or painted of a rather light colour, but not white, and the reflection from this will, in nearly all cases, be sufficient to prevent dark shadows on the least illuminated side of the face. A movable screen reflector, made of light calico, may be used according to circumstances, to modify the dark shades. Every variety of lighting, from the Rembrandt to almost flat effect, can be easily obtained in such a room by varying the position of the sitter and the camera. By having a background at each end of the room, either side of the face may be taken equally well, and this

is a point by no means to be undervalued by the portraitist, especially as most persons have one side of the face better than the other. In short, no glass-room is in any degree approaching a perfect one unless the sitter can be equally well taken in any position or view; the light should always be made to suit the sitter, and not the sitter's position determined because of the arrangement of the light.

A room built as here described will be much more healthy than the usual conservatory-like structures, which are cold in winter, hot in summer, leaky in wet weather, and dirty all the year round. All rooms devoted to photography should be thoroughly ventilated, and the chief point in ventilation is to provide for the escape of the hot and vitiated air which rises to the top of the apartment. In the glass-room, therefore, the very ridge is the place. Doors and side windows are well enough for letting in cold air, for which, by-the-bye, there is no room till the hot air escapes; but the heated atmosphere crowds to the top of the room, eager to go out in that direction, but objecting to go in any other. Provide it with proper means to get out, and the colder and purer air will always find a way to take its place. A good glass-room should also be provided with means to heat it in wet and cold weather. If a hot-water system cannot be used, a good household grate, giving a cheerful fire, may be provided on the bricked-up side. Above all things, that deadly abomination, the ordinary gas stove, should be avoided. By attending to these minor points, the sitter will feel and look more pleasant during the ordeal, and the photographer himself will derive greater health and pleasure in following his business.

TRANSPARENCIES FOR DECORATING
WINDOWS, AND FOR THE MAGIC LANTERN.

AN interesting application of photography is the production of transparencies for window decorations, and for the magic lantern. They may be produced by the dry or the wet process. The first proceeding is to obtain a suitable negative. It should be clear, clean, and very sharp. The high lights should not be too opaque, but full of half-tone, and the shadows free from fog and full of detail. Although there is no fixed size for the magic lantern, yet $3\frac{1}{4}$ inches square is a usual size, and for which the ordinary stereoscopic negative is well adapted; but every person will, of course, make the pictures the dimensions to suit either the lantern he uses, or the window he wishes to ornament. If the negative be the same size that the transparency is wished, the proceeding is very simple, as any of the dry processes may be employed. The negative has to be placed in the printing-frame, and the dry plate put in contact, as in ordinary printing. A few seconds' exposure in diffused light, varying with the intensity of the negative, will be enough; or gaslight may be used, when a few minutes will be necessary. The plates should be developed by the acid pyro, as that gives a better tone than alkaline pyro; pyrogallie and citric acid yield a bluish-black, and pyrogallie and acetic acid a brown-black tone. The picture, if intended for the magic lantern, should not be varnished, unless the blacks are foggy, but mounted by putting another glass the same size to protect the collodion film, and binding the edges like a passepartout. If intended to be suspended as a transparency, it should be varnished,

and the collodion side protected with a *ground* glass. The edges may be secured with paper or cloth, to keep out the dust. Instead of a dry plate, an ordinary unmounted, albumenized paper print may be used, if it be printed much darker than usual. The effect is not so good as a glass plate, but it is more readily produced. The print may be soaked in spirit varnish to render it more transparent. Very perfect results may be produced by carbon printing.

If, however, the negative from which the transparency is to be made is larger or smaller than the size required, the lens and camera must be employed, and the negative must be copied *by transparency*. Many methods of doing this will suggest themselves to ingenious persons; one of these is by placing the negative in a window, all the rest of which is darkened, and copying the negative by the light that thus streams through it; the rest of the room must, of course, be in complete darkness.

Another plan is by the use of "a copying camera for transparencies." This instrument is a kind of double bellows-bodied camera; that is, another body is provided *before* the lens, in addition to the usual body behind it. This extra body is provided with sliding holders, to receive different-sized negatives. The central screen carrying the lens can be freely moved backwards or forwards, so as to approach either the negative or the ground glass, so that either a reduced or an enlarged copy may be made. To use the camera, place the negative in its holder at one end, and the usual ground glass in the other, screw the lens on to the central screen, and put it in its place. If the size is to be reduced, push the negative further from the lens, and put the ground glass nearer; if it is to be increased,

reverse the plan, putting the negative nearer and the ground glass further from the lens. How much nearer or further the lens must be from the ground glass, or from the negative, depends on the focal length of the lens, and on the desired degree of enlargement or reduction.

The adjustment made, the camera may be inclined to the north sky; and the light streaming through the negative will form its image on the ground glass in the usual manner. A quarter-plate double combination lens, with central diaphragms, will be found convenient for this work. First focus with open aperture, then put in the smallest stop, and proceed as if for producing an ordinary negative; but instead of a negative a transparent positive will be produced. Most usually the ordinary wet method will be found the easiest and simplest. Pyrogallie acid or iron may be used as a developer, the former by preference, as yielding a better tone and denser image. If the latter be used, and the tone be not approved, intensify, after fixing, with pyro 2 grains, citric acid 1 grain, water 1 ounce; or to produce blacker tones, wash the plate well from the hypo or cyanide fixing solutions, and pour on a weak solution of chloride of iridium until a rich black tone is produced.

STEREOSCOPIC PICTURES.

THE principle of Stereoscopic Pictures depends on the production of two pictures taken of the same object at slightly different points of view. Under all ordinary circumstances the best effect is produced by the use of the binocular camera, as the two lenses are then employed on one camera, and only one plate is used to receive the two pictures. In

selecting the points of view, particularly in landscapes, it is especially desirable to have some objects in the foreground, otherwise the picture, when seen in the stereoscope, will be tame and flat. Sometimes a post, an old tree, even a few twigs, will be sufficient; but it is of the highest importance that some object should be there, so as definitely to mark the foreground, and then all other objects will fall into their relative planes, and communicate the sense of relief.

When the binocular camera is used, the pictures, after being printed, must be cut and transposed, so that the right-hand one shall be placed on the left, and *vice versa*. When many copies are wanted, it is better to cut the negative itself, transposing the two halves, and then glue them by the corners to another glass, and thus the paper prints will be printed right at once.

In producing stereo-negatives, a rather different treatment is required than for other pictures. It is not so much a brilliant picture, that may look well out of the stereoscope, that is wanted, as a soft and delicate one, that looks well in the instrument. In particular, there must be no masses of hard white light, or patches of deep black shadows without detail. The negative must be exposed sufficiently long in the camera to bring out all the details in the deepest shades; and in developing, the intensifying must not be carried so far as to fill up any of the details in the high lights. By these means a picture will be produced which, though somewhat lacking in brilliancy out of the stereoscope, will amply repay by the beauty of its details when seen in it.

PART II.

GENERAL REMARKS ON THE VARIOUS DRY PROCESSES.

THE instruction previously given refers to the use of the collodion plate in its wet state. Various means have been devised to use the plates dry, so that, being prepared before starting, they may be exposed during a journey away from home, and developed and finished on the return. This method of using sensitive plates naturally increases the usefulness of photography, but the knowledge how to prepare a wet plate is not alone sufficient to prepare a dry one. If the usual wet sensitive plate be allowed to dry, without taking any precautions, it will be found to be quite useless for taking a photographic picture upon. It has to pass through another process, more or less complex, to enable it to be so used.

Nearly all the old dry plate processes are the same in their general principles; they start by coating a plate with ordinary bromo-iodized collodion, and sensitizing it in a nitrate of silver bath; their differences consist in the various methods employed to preserve the sensitiveness that the plate has attained—such as the albumen, collodio-albumen, washed-plate, tannin, and other processes; but, being slow, they do not keep pace with this age of progress and velocity. A few years ago the idea of dry plates being quicker than wet was

laughed at and scouted as an absurdity; now, ten times quicker than wet is not considered sufficient, and some dry plate manufacturers are advertising their plates as twenty and thirty times quicker than wet collodion. This is running to the other extreme, and in a dangerous direction, for a large majority of failures in working the gelatine dry plates that are only ten times quicker is due to over-exposure. What, then, must be the risks and difficulties in exposing and manipulating those enormously rapid plates? Photography is, however, one of those art-sciences in which there is no finality, and in which rapid and radical changes occur when they are least expected; so our wisest course is to accept what appears to be inevitable, and prepare for the coming REVOLUTION, by making ourselves acquainted with the new conditions of practice, and endeavouring to acquire a knowledge of the surest way to success.

RAPID GELATINE PLATES.

FOR negative purposes the gelatine process is fast superseding all others, and rapidly revolutionizing the practice of photography. It is, therefore, necessary to know how gelatine plates are made, and how they behave in the camera and developing-room. Numerous methods of making the gelatino-bromide emulsion have already been published, but as they are only modifications of Mr. Kennett's formula, it will be but justice to that gentleman to give his process *intact*, for to him most certainly is due the credit of having made the gelatine emulsion process practically and commercially successful.

MR. KENNETT'S PROCESS.

"FORTY grains of Nelson's photographic gelatine are soaked in water till thoroughly swelled, and then drained. Thirty grains of potassium bromide are next dissolved in eight drachms of water, and poured on the swollen gelatine. The jar containing it is next placed in a can of hot water till the gelatine dissolves, and a perfect mixture is obtained. Forty grains of nitrate of silver are next dissolved in eight drachms of water, and poured into the gelatine mixture little by little, stirring with a glass rod the whole time. The emulsion is next poured into a flat dish, and allowed to set thoroughly, and is then cut up into little lumps or squares, with a piece of clean glass, and covered with water, and allowed to stand for an hour, when the water is changed, and the washing continued for four or five hours. The wash water is tested for free bromide of potassium by taking a portion of it in a test tube, and adding a drop of silver nitrate. The washing must be continued until a drop of nitrate of silver solution ceases to cause milkiness. After thoroughly draining, the gelatine is again dissolved by placing the vessel containing it in a jar of hot water, and the whole amount is, after adding one drachm of alcohol, made up to two ounces of solution." When the emulsion is in this condition the glass plates, previously cleaned with a little tripoli or putty powder, and a pellet of cotton, are warmed, and coated with the mixture, and placed on a level shelf to set and dry. Mr. Kennett recommends the following method:—"When the solution is completed, take a second bottle, and filter through a piece of muslin the contents of the first into it; this at once gets rid of all bubbles occasioned by the shaking up; you have now

a fine creamy emulsion ready for use. Apply it in the following manner:—Take a clean plate, warm it, and place it on a pneumatic holder; pour on the centre sufficient to cover the same, and with a thin glass rod guide the emulsion over the surface; tilt the plate to get an even film, and pour from off one corner any surplus quantity into the bottle, and place the plate flat on a levelled table or shelf until dry, which it will do, at a temperature of from 60° to 70° Fahr., in about three hours.” Convenient drying boxes are now provided for the latter part of these operations. Some manipulators prefer bromide of ammonium, and others recommend slightly different proportions, and more elegant modes of washing, such as dialyzing; but very excellent results have been obtained on plates prepared by the foregoing method, and it is as simple and reliable as any. All the operations must, of course, be performed in a suitably lighted chamber, and the light must be very much more non-actinic than is necessary for wet plate manipulations.

In addition to the above, two or three of the more modern gelatine emulsion processes are given, to enable the amateur to make his own plates if he desires to do so; and that known as Mr. A. Cowan's ammonia nitrate process will be the best for his purpose; but it is scarcely worth any one's while making them, for there are so many really good plates made and sold by eminent manufacturers at very reasonable prices, and there are none better than those made and sold by Mr. Werge.

MR. BURTON'S MODIFIED GELATINE EMULSION
PROCESS.

A.—Potassium bromide	...	...	340 grains
Nelson's No. 1 gelatine	...	...	60 „
Water	...	...	20 ounces
Hydrochloric acid...	(about)...		2 minims
B.—Iodide potassium	...	...	10 grains
Water	...	...	1 ounce
C.—Nitrate silver (dry)	...	...	400 grains
D.—Ammonia .880	...	...	6 drachms
Alcohol	...	...	8 „
E.—Heindrich's gelatine	...	...	360 grains
Water	...	...	20 ounces

Place A in a hock bottle, and warm till the gelatine is melted; then add the dry nitrate of silver, and shake up until it is dissolved. Next add B.

The next operation is that which is usual in the boiling process. The emulsion is poured into any convenient vessel, and boiled for about fifty minutes; it is then allowed slowly to cool to 120° Fahr. D is now added, and the whole allowed to stand for forty-eight hours. At the end of that time the supernatant fluid may be poured off almost quite clear. Twenty ounces of water is again added, the emulsion being stirred into it. The whole is once more allowed to stand for forty-eight hours, when the water is again poured off, and the emulsion is sufficiently washed. Then E is added, the vessel warmed, and the emulsion is complete. Two ounces of methylated spirits, with twenty grains of salicylic acid dissolved in it, and four or five minims of ammonia, to counteract the acidity of the gelatine, are added. The

emulsion should be kept a few days before coating plates with it.

The chief advantages claimed by Mr. Burton in the above process are:—1st, A decrease in the time and labour of washing the emulsion; 2nd, An increase in the quantity of bromide of silver that may be suspended in the gelatine solution, and a finer state of division, both of which are necessary conditions in making an emulsion that will yield dense and finely graduated negatives.

The following is the developer that Mr. Burton recommends to be used with plates prepared by his method:—

Pyro.	...	...	1 to 2 grains
Ammonia bromide	...	...	1 grain
Ammonia .880	...	...	3 minims
Distilled water	...	...	1 ounce

MR. ALEXANDER COWAN'S METHOD.

To obtain "uniformity in emulsions," Mr. Cowan recommends the following—

Potassium bromide ... 6,912 grains

Made up to 100 ounces with distilled water.

Silver nitrate ... 9,216 grains

Also made up to 100 ounces with distilled water.

Hydrochloric acid ... 30 minims

Also made up to 100 ounces with distilled water.

Gelatine No. 1, weighed into 150 grain packets; gelatine (Heinrich's), weighed into 960 grain packets.

A 5,000 grain flask of each of the above solutions is taken. The acidulated water is poured into a jar or flask, and a 150-

grain packet of gelatine is soaked and dissolved in it. The flask of silver solution is gradually stirred into it in the dark-room. The flask of bromide solution is poured into the vessel used for boiling, and the silver and gelatine gradually mixed. The whole is then placed in the boiling apparatus, and boiled for about an hour, during which time the 960 grains of gelatine are allowed to soak in a pan of water. After removing the emulsion from the fire, the gelatine is at once stirred in, leaf by leaf, and allowed to set for eighteen hours. It is then squeezed through coarse mosquito netting into water, thoroughly washed in the ordinary way, and melted up. This should make about fifty ounces of emulsion after the addition of four ounces of alcohol; and if fifty grains of thymol be added, it will keep admirably for months. If the whole of the emulsion is to be used up at once in coating plates, the thymol is unnecessary.

AMMONIA-NITRATE EMULSION.

Mr. A. Cowan recommends the following modification of Dr. Eder's process, especially for amateurs:—

Ammonia bromide...	...	...	720 grains
Silver nitrate	...	...	960 „
Heinrich's gelatine	...	...	960 „
Water, distilled	...	...	30 ounces

The silver is first dissolved in half the water, then strong liquid ammonia is added until the precipitate formed is just re-dissolved—this takes nearly two ounces of ammonia. In the remaining fifteen ounces of water the bromide is dissolved, then one-third of the gelatine is added and melted at a

low temperature. When the gelatine is all melted, the ammonia-nitrate solution is gradually mixed with it in the usual manner. The remaining two-thirds of the gelatine having been, meanwhile, allowed to swell in a pan of water, is melted, and thoroughly mixed with the emulsion; after which it is set aside, and allowed to cool for eighteen hours, and then washed in the usual way. If the emulsion is allowed to stand a day or two before using, it will improve in sensitiveness.

ON EXPOSING GELATINE PLATES.

THE very slowest of gelatino-bromide plates being so much more sensitive than wet collodion plates, and more susceptible to the effects of weak rays and extraneous light, too much care or attention cannot be devoted to the working condition of the camera, dark slides, and lens, so as to avoid fog or flatness, which may easily be caused by the slightest light-leak in any part of the apparatus. As soon as it is determined to employ these extra rapid plates, and before any attempts at exposure are made, the whole of the cameras and dark slides should be carefully examined, particularly the hinged slides and backs and the jacket of the lens, to see that not the faintest ray of extraneous light can possibly enter the camera. The focussing cloth should also be seen to, and placed carefully over the back of the camera when the slide is drawn up; even in the studio this should not be neglected, and for outdoor exposure it is a condition that is absolutely imperative. Many good plates have been spoiled and condemned through inattention to this necessity.

Over-exposure should also be carefully avoided, especially

at the commencement of operations, with these highly sensitive plates. It is best to give the shortest exposure possible at first, as it is much easier to see and calculate the amount of under-exposure, than to estimate how much less is required from the appearance of too much exposure. If under-exposure be attended to at the beginning, one or two experiments will enable the gelatine plate novice to judge of and arrive at the right exposure, whereas *many* plates are frequently spoiled, without arriving at the proper time, by beginning with and continuing to give too much time. Indeed, ninety per cent. of early failures may be safely attributed to over-exposure. Therefore, the shortest and cheapest way to obtain the correct time of exposure is to give the least time possible, and work upwards.

Since the introduction of these rapid gelatine plates, and especially those made by Mr. Werge, the necessity for employing quick lenses is entirely set aside, and no one need employ a quicker or more expensive lens than a Dallmeyer rapid rectilinear or a Ross' rapid symmetrical for portraits, even in the studio; while for landscape work an ordinary single lens is all-sufficient.

ON DEVELOPING GELATINE PLATES.

THIS part of the gelatine process, though extremely simple, requires the utmost care and attention, especially to the condition of the "dark room" and choice of working light. If these two things are not carefully attended to, all sorts of annoyances and unsatisfactory results will arise. The faintest ray of *white* light must not be allowed to enter the room, either through the window sides, top or bottom of the

door, or chinks in the walls, ceiling, or floor; yet there may be abundance of light to work by, if it is only of the right quality. This can only be determined by experience and testing, not only at the commencement, but from time to time, for all coloured glasses, paper, cotton, and silk fabrics change by the action of light. Even the spectroscope is not a sufficiently reliable test for highly sensitive conditions. Fog, or no fog, on the plates to be manipulated is the only safe test in photography. What did for the quickest wet plate will certainly not do for the most sensitive dry plate process, and it is folly to attempt to work the latter under the most satisfactory conditions of the former. A safe way is to begin with one sheet of good orange pot metal and one sheet of moderately dark ruby flashed, and if the colour is distressing to some weak eyes, it may be modified by the addition of an extra piece of lightish green. The light or window may be as large as convenient—the larger the better, and more comfortable to work in; the only imperative condition is to have it of the right colour and quality; that is for filtered daylight, but the very best working conditions are secured by employing artificial light, either gas, paraffin oil, or candle light. If any one of these lights is employed, one thickness of ruby or good orange glass is sufficient; and to avoid heating the room, or risk of shedding any white light on the plates, the artificial light should be placed *outside* the “dark room.” This may be done in various simple and inexpensive ways, and still retain the power of admitting white light when required. One great advantage derived from the use of artificial light is its constancy. By the employment of an unvarying light the eye is more readily trained, or educated, and seldom or never deceived as to density when examining

the negative either by reflected or transmitted light. If the use of filtered daylight were boldly ignored, numerous advantages would be the reward, especially in a climate like ours, where the light is so very variable. Having secured the proper conditions of a good working light, the process of development may be commenced with the utmost confidence, either with alkaline pyrogallic, or with oxalate of iron. Both are simple and certain, but each gives different or special results. The pyro. developer yields yellowish and thin-looking negatives of a very non-actinic tint, while the oxalate developer yields rich bluish-black negatives or transparencies, resembling the appearance of a good wet plate by transmitted light. All or any bromide of silver plates can be developed in the oxalate of iron solution, and it is the cleanest and simplest process imaginable. To obtain good results by this process, it is only necessary to take the exposed plate out of the dark slide, lay it face uppermost in a clean glass, porcelain, or ebonite dish, and pour the clear solution on, and leave it standing for two or three minutes; by that time the whole of the picture will be distinctly visible, and the requisite density is generally obtained by leaving the plate in the developing solution until all the shadows of the picture, except the very blackest, have entirely disappeared; but on no account should the blackest or densest shadows of the picture lose their opal appearance on the surface of the negative. If that should occur, it may be unquestionably attributed to one of two things—over-exposure, or diffused white light—or it may be due to a combination of both these evils. The oxalate solution can be obtained all ready for use, and of a good keeping quality; or it can be made as occasion requires in the following manner:—Dissolve six ounces of

neutral oxalate of potash in one pint of boiling water, and when the potash is all dissolved, add one ounce of oxalate of iron. The iron dissolves quickly, and as soon as the solution is cool and settled, it is ready for use. Decant, and employ the clear solution only. When the development is complete, the solution may be poured back into the stock bottle, and used over and over again, until it is quite exhausted. The action of the oxalate solution becomes slower by use and age, and when it is in this state the negative requires longer immersion to obtain the requisite density. An old solution, or a dilute fresh one, should be employed when the plates are over-exposed. The best results, however, are always obtained when the proper amount of exposure has been given, and the oxalate bath in good working order.

The oxalate and iron solutions may be kept separately, and the ferrous oxalate made as required for immediate use by mixing the following proportions.

FORMULA FOR IRON DEVELOPERS.

Solution No. 1.—Dissolve 6 ounces of neutral oxalate of potash in one pint of boiling water. Allow it to cool, and then bottle it for use as required.

Solution No. 2.—Dissolve 2 ounces of protosulphate of iron in 5 ounces of water. Allow it to cool, then bottle for use, and add 5 minims of sulphuric acid.

To develop. Take 6 drachms of solution No. 1, and 2 fluid drachms of solution No. 2. Pour the given or requisite quantity of No. 1 into a clean glass measure, then add the proportion of No. 2.

Put the plate into a dish and develop in the usual manner,

90 WERGE'S FORMULÆ FOR PYRO-DEVELOPMENT.

carrying the development a little further than with the pyro.; wash, fix, wash, and dry as directed at page 94.

WERGE'S FORMULÆ FOR PYRO-DEVELOPMENT.

Portraits.

No. 1.

Water, distilled	...	...	...	6 ounces
Citric acid	...	...	...	60 grains
Pyrogallic acid	...	...	...	1½ ounces

No. 2.

Water, distilled	...	...	...	5 ounces
Bromide ammonium	...	...	...	90 grains
Liquid ammonia, 880°	...	...	...	1 ounce

Landscapes.

No. 1.

Water, distilled	...	...	...	6 ounces
Citric acid	...	...	...	60 grains
Pyrogallic acid	...	...	...	1½ ounces

No. 2.

Water, distilled	...	...	...	5 ounces
Bromide ammonia	...	...	...	1 ounce
Liquid ammonia	...	...	...	1 ounce

(The above will keep indefinitely).

If it is not desirable to dissolve so much pyro at once, make a solution of pyro, 6 grains to 1 ounce of water, and employ it in the same manner with No. 2 solution, using equal parts of each.

To develop, dilute Nos. 1 and 2, 15 times with common water—say one drachm of the concentrated solution to

15 drachms of water—and take equal parts of each dilute solution—say half an ounce each for a quarter plate. Place the plate in a dish, and flow the solution over. When sufficiently developed, wash the plate with common water, and fix in a solution of hyposulphate of soda, 6 ozs. of hypo to 1 pint of water. When fixed, wash well, and set the plate in a rack to dry.

KENNETT'S PYRO DEVELOPER.

No. 1.—To 4 grains of pyrogallie acid add 1 oz. of water.

No. 2.—To $\frac{1}{2}$ an oz. of strong ammonia, add 8 ozs. of water.

No. 3.—To 3 drams of bromide of potassium, add 8 ozs. of water.

Mix 2 and 3 in one bottle ; they keep better together than separately.

In cold weather, a little less bromide or a little more ammonia may be used with advantage.

After exposure, put the plate into a dish of water for five minutes or longer, and commence the development by adding to one ounce of No. 1, one half-dram each of Nos. 2 and 3, and pour on the plate ; in a few seconds the image will appear ; continue the development until sufficient density is obtained ; or, if any difficulty occurs in getting sufficient density, wash off, and don't be afraid of using the water ; and intensify with the following :—Pyrogallie acid three grains, water one ounce, with eight drops of glacial acetic acid, to which add one or two drops of a 20-grain solution of silver ; density to any amount will now be readily obtained. On no account let either the developer or intensifier remain on the

plate after it has become discoloured, or a stained film will be the result. Should either the developer or intensifier quickly discolour, add a little more bromide to the first, and a little more acid to the last.

FORMULA WITH SULPHITE OF SODA AND PYRO.

Stock Solution No. 1.

Pyrogallie acid	...	...	...	1 ounce
Citric acid	...	...	...	60 grains
Sulphite of soda	...	...	...	2 ounces
Water to make bulk up to...	...	...	8	„

Stock Solution No. 2.

Strong ammonia	...	...	...	1 ounce
*Bromide of potassium	...	...	$\frac{1}{2}$	„
Sulphite of soda	...	...	...	2 ounces
Water to make bulk up to	...	...	8	„

Procure two eight-ounce stoppered bottles, and label them Nos. 1 and 2. In No. 1 put the citric acid, and in No. 2 the ammonia and bromide. Now take four ounces of sulphite of soda and put the same in a jug, pouring over it about ten ounces of hot water. With a little stirring the sulphite will be all dissolved in five minutes. One half of this solution must now be poured into the bottle of pyro., which, as soon as dissolved, can be transferred to the stoppered bottle No. 1. As this will not entirely fill the bottle, more water must be

* Much better and clearer pictures for landscape work are produced by using a large quantity of bromide in the developer; an ounce may be used instead of half-an-ounce with very little alteration as regards time required for exposure.

added from the tap to make up to *eight* ounces. The remainder of the sulphite solution should then be poured into No. 2 bottle, the filling of which must also be completed from the tap. These solutions will also keep indefinitely.

To Develop.—Take one part of No. 1 and add fifteen parts of water, doing the same with No. 2, and keeping the diluted portions separate until wanted. Enough may be made to last a whole day if a number of plates are to be developed.

The above gives a dark grey deposit, and produces a negative somewhat like a wet collodion plate, free from red or green fog, and is, consequently, very much in favour among many operators.

OVER OR UNDER-EXPOSED PLATES.

ALTHOUGH the oxalate of iron developer is strongly recommended as the best and cleanest, it is only so when the exposures can be properly timed. It does not allow of so much latitude in exposure, or modification of proportions, as the alkaline pyro. developer, and negatives are sometimes lost by its inapplicability, especially to *under*-exposed plates. For the latter condition of exposure, many plates may be saved by using the alkaline pyro. instead, and especially by flooding the plate first with the ammonia-bromide solution only, and then adding the pyro. solution as required; while *over*-exposed plates may be saved by flooding them first with the pyro. solution only, and adding the ammonia bromide solution slowly and carefully, until the negative is gradually brought up to its requisite density. A little practice in these modifications will soon enable the manipulator to preserve or rescue many plates that would otherwise be consigned to the list of failures.

ON FIXING AND WASHING.

THIS can only be done with hyposulphite of soda, and a good working proportion is about four ounces to one pint of water; in some cases the quantity may be advantageously increased to six ounces, for some plates are not chemically fixed when they are visibly so, and it is always imperative that the plates should be chemically fixed—most especially if after-intensification has to be resorted to—or yellow hazy stains will appear, which are very prejudicial to the quality of the negative. After the negative is developed, it should be washed immediately to free it from any further action of the developer, placed in the hypo. bath, and allowed to remain a *few minutes* after the creamy appearance has all disappeared from the back of the plate. Should it then be discovered that after-intensification must be performed, it is a safe precaution to immerse the negative, after washing, in a bath of *fresh* hypo. for two or three minutes, wash the plate again, and then immerse it in a saturated solution of common alum for about five minutes. This will harden the film, and remove all risks of blistering or frilling, and enable the plate to endure all the ablutions it must necessarily undergo in the process of re-intensification. After the operation of fixing, the plates should be placed in a dish or other vessel, and treated to three or four changes of water in the course of an hour, then finally well washed under the tap, and set in a rack to drain and dry spontaneously. No heat should be applied to hasten the drying under any circumstances; a good current of air is an excellent dryer, or the process of evaporation may be accelerated by dipping the plates in a bath of methylated alcohol before placing them in the drying rack.

The operation of fixing need not necessarily be conducted in the yellow light, as the plates may be safely exposed to gaslight or daylight immediately after washing off the developer. I put this to a satisfactory test a short time ago by exposing a developed gelatine plate to daylight for four consecutive days before fixing, and found that no injury was done to the picture. The time of fixing did not appear to be prolonged, nor was there any appearance of "veiling" or other defect.

THE ALUM BATH.

If any gelatine plates exhibit a tendency to frill, they should be immersed in the alum bath *before* fixing. After development, the plate should be slightly washed under the tap, and then placed in the solution of alum for about five minutes, and then washed, fixed, and treated as described. The solution of alum should be saturated; about three ounces of powdered alum to one pint of water is sufficiently strong. However, gelatine plates now-a-days very seldom exhibit the weakness of frilling, and the alum bath is chiefly employed to remove the yellow colour that alkaline pyro. imparts to the negatives. For that purpose it is better to add a little citric acid to the alum solution—about half an ounce to the pint.

As oxalate of iron developed negatives never require the above treatment, it is another good reason for giving that form of development a decided preference.

ON INTENSIFYING GELATINE PLATES.

GIVEN the correct amount of exposure and proper development, gelatine dry plates do not require either immediate or sub-

sequent intensification ; but in the practice of dry plate photography, as well as wet, some circumstances are constantly arising to render re-development or after-intensification necessary. I think it advisable, however, in the manipulation of gelatine plates, to have a wholesome dread of free nitrate of silver, and do not recommend re-development as it is generally practised. Neither before nor after fixing would I either employ or recommend the use of free silver to intensify gelatine plates, for so many risks are run and so many negatives ruined thereby. From the compact nature of the film it appears to be impossible to deal with these plates as we have been accustomed to deal with wet collodion negatives, and we are driven to do and adopt things to which we formerly had a great and well-founded repugnance. The use of bichloride of mercury as an intensifier has long been out of court among wet-plate workers, but in dry plate, and particularly gelatine dry plates, its use is far less objectionable than the use of nitrate of silver. Therefore I give the preference to bichloride of mercury, and the best way to use it is as follows. After the plate has been well fixed, washed, and dried, put it into a bath of bichloride solution—a cold saturated solution is strong enough—and allow it to remain until the image is whitened ; the more density required, the longer the plate must remain in the bichloride bath. When sufficient of the mercury has been deposited, the plate should be taken out, well washed under the tap, and then placed in another dish, or bath, containing dilute ammonia—one drachm of strong liquor ammonia to one ounce of water. This will blacken the mercurial deposit, and give the negative the appearance of a wet collodion plate by transmitted light. The negative should be a little over-intensified to

allow for a slight loss of density, which will ensue on varnishing. I have treated many and various negatives in the manner above described, and have not noticed either increase or diminution of density after obtaining a number of prints.

Another mode of intensifying and converting yellow pyro. negatives into black ones, is recommended by Mr. Kennett, and is as follows:—

No. 1.

Hyposulphite of soda	...	...	1 ounce
Water	...	...	3 ounces

No. 2.

Protosulphate of iron	...	...	1 ounce
Water	...	...	3 ounces

When both are dissolved, mix the two solutions, and allow the mixture to stand a short time. When the negative has been well washed after development, it is placed in the above mixture, and the image is fixed and intensified at the same time. The iron in the mixture being a powerful astringent, renders the use of the alum bath unnecessary, even for plates that are prone to frilling.

The yellow colour may also be extracted from the pyro. developed negatives by immersing them in water acidulated with sulphuric acid after fixing and washing—

Water	...	...	40 ounces
Sulphuric acid	...	...	1 ounce

INTENSIFICATION OF NEGATIVES.

Dr. Eder's Method with Mercury.—The following solutions are required:—

No. 1.

Mercuric chloride ...	...	...	$\frac{1}{4}$ ounce
Water ...	...	...	1 pint

No. 2.

Ammonia .880 ...	...	...	2 ounces
Water ...	...	...	1 pint

No. 3.

Potassium iodide ...	...	...	1 ounce
Water ...	...	...	1 pint

No. 4.

Hypo. ...	...	...	$\frac{1}{2}$ ounce
Water ...	...	...	1 pint

No. 1 generally wants filtering to give a clear solution. The plate, being well washed after fixing, is first immersed in No. 1, when, after a short time, the image becomes perfectly white.

Mercury subchloride, being insoluble in water, remains in the film with the silver chloride, so that in the place of the original silver there is a mixture of silver chloride and mercury subchloride. Both of these happen to be white substances, so that, although there is a considerably increased deposit, the opacity of the film to transmitted light is not much affected, and a further operation becomes necessary. This depends on the amount of additional density required. If it be but slight, the plate, after washing, is immersed in the ammonia (No. 2) solution, which rapidly turns the previously white image black.

If a considerable increase of density be wanted, the plate is, after treatment with No. 1 and washing, immersed in No. 3, which converts the silver chloride and mercury subchloride into silver iodide and mercury subiodide, and then with No. 2 as before. In this case mercury suboxide, as previously, is formed, and a similar complex compound; but silver iodide, being insoluble in ammonia, remains in the film, and so gives considerably greater density.

Finally: if, after this, the image is found to be over-intensified, it may be reduced again by treatment with the hypo. No. (4) solution, which slowly dissolves out the silver iodide, ultimately leaving an image hardly distinguishable from that produced by No. 1 and No. 2 alone.

Dr. Monckhoven's Method with Mercury.—Two solutions are prepared:—

No. 1.

Mercuric chloride	...	...	...	$\frac{1}{2}$ ounce
Potassium bromide	...	...	...	$\frac{1}{2}$ "
Water	...	...	...	1 pint

No. 2.

Silver nitrate	...	...	...	$\frac{1}{2}$ ounce
Water (distilled)	...	...	...	$\frac{1}{2}$ pint
Potassium cyanide	...	...	...	$\frac{1}{2}$ ounce
Water	...	...	...	$\frac{1}{2}$ pint

The potassium cyanide solution should be added gradually to the silver solution. At first a dense precipitate will be produced, but as more is added this will dissolve up again. When there is only a little of the precipitate not dissolved, no more cyanide is added, and what little remains should be thrown down the sink.

The washed plate is immersed in No. 1, again washed, and then in No. 2. The plate should be carefully watched, and taken out immediately the darkening is complete, otherwise the density will again be reduced.

Mr. Selle's Method with Uranium.—A solution is prepared—

Uranium nitrate	...	...	...	$\frac{1}{4}$ ounce
Potassium ferricyanide (red prussiate of potash)	}		...	$\frac{1}{4}$ "
Water			...	1 pint

A small quantity of a reddish-brown precipitate is usually formed in making the solution; this should be allowed to settle, or the solution filtered before use. The well-washed plate is immersed in this solution, the image gradually increasing in density, the increase ultimately being very great. The metallic silver reduces the potassium ferricyanide to ferrocyanide, and with the potassium ferrocyanide uranium forms an insoluble double cyanide, which becomes precipitated on the image. Unfortunately for this intensifier, hypo. also reduces potassium ferricyanide to ferrocyanide, so that unless the plate be very thoroughly washed, a precipitate is produced all over the film.

Mr. Pricam's Uranium Intensifier.—

1.				
Nitrate of uranium	...	...	2	grammes
Water	...	...	100	"
2.				
Red cyanide of potash...	...	...	2	grammes
Water	...	...	100	"

The negative, after having the alum bath, is washed and

dried. It is now placed in water for a few seconds, then covered with solution No. 1. Now drop into the developing glass several drops of No. 2, and pour back over the negative. Flow to and fro on the film until the requisite density is obtained. It is necessary to remember that the red-brown colour of the film is extremely adiactinic, and the negative may prove more intense than it seems. It is necessary to wash thoroughly in order to remove every trace of uranium.

Bromide of Copper Intensifier.—

Copper bromide ...	...	...	1 drachm
Water (distilled) ...	...	...	1 ounce

When the negative requires only a little intensification, the plate, after fixing and washing, is placed in the solution of bromide of copper until the image is whitened: it is then washed, and placed in the oxalate of iron solution (same as employed for developing) to blacken. When this, or any of the mercuric intensifiers, is to be used, the negative must be thoroughly well fixed and washed previously, or brownish yellow stains will appear wherever the bromide of silver was not entirely removed.

ON VARNISHING GELATINE PLATES.

It has been stated that gelatine films do not require varnishing, but that is not my experience, and I have come to the conclusion that they require more careful varnishing than films of collodion. Many negatives have been completely ruined by printing proofs only before they were varnished. If there is the slightest damp in the atmosphere, the sensitized paper, or the pads, particles of silver are sure to be absorbed by the gelatine film, which will eventually develop into red spots,

and grow larger and deeper in colour the longer the plate is exposed to the light while printing. Unfortunately, these insidious silver spots do not reveal themselves at first, or they might be easily removed with a little weak solution of cyanide of potassium. They have, unhappily, the treacherous habit of lying in the film dormant and invisible until after the plate is varnished, when it is too late to remove them successfully and certainly. If a gelatine plate should be printed for proof or otherwise, it should be washed, and treated to a bath of weak cyanide; well washed, and dried again before it is varnished, so as to reduce the risk of those fatal silver stains appearing; but the only safe way is to varnish first and print afterwards. So much importance do I attach to gelatine plates being properly varnished. I treat them all in the following manner, and have no reason to suppose that they receive too much attention:—As soon as the film has dried spontaneously, I hold the plate over the flame of a spirit lamp, or before a fire, just long enough to expel any moisture that may be hanging about. I then coat it with a thick enamel collodion, and when that is set and perfectly dry, I varnish it with a good-bodied negative varnish in the usual way, and I have never found that negatives so treated have behaved in any eccentric manner, but have invariably conducted themselves as good and properly-behaved negatives should, yielding any required number of good and brilliant prints, and rewarding me amply for the pains and care I had bestowed on their production.

I must say, however, that my greatest successes have invariably been obtained by using the ferrous oxalate developer, and I most decidedly give a preference to that mode of development. Negatives so obtained print quicker than pyro-

developed negatives, and do not appear to change either by much printing or long keeping; whereas pyro-developed negatives sometimes grow denser, and sometimes become fainter, during the printing. The latter defect I have generally attributed to an excessive dose of ammonia, which produced a kind of false density, more from ammoniacal stains than a reduction of silver by the agency of pyrogallie acid; and as the ammonia was gradually liberated by the action of light, or other causes, such negatives gradually lost density, and, in some instances, disappeared almost totally.

In conclusion, I beg most respectfully to impress upon every gelatine plate-worker that, from first to last, whether he makes his own plates, or employs those made by others, he should give his utmost and most intelligent attention to every stage of the manipulation of these marvellously rapid, reliable, and comfortable substitutes for all the annoyances, dirt, and discomforts attending the practice of wet collodion. If he does, he will find that there is a power in their rapidity, a comfort in their cleanliness, and a charm in their beauty, that never were dreamt of before in the philosophy of photography.

HINTS AND MEMORANDA.

WHEN working away from home, be sure to take everything with you, and never rely upon what you can get "there." It is provoking to find that you have brought everything with you except, perhaps, the tripod screw, the ground glass, or the dark slide.

Double or treble the exposure in the camera is required during an easterly wind.

Examine, and, if necessary, re-yellow, the window of the dark-room in the spring of the year. The chemical obstruction sufficient for winter is quite inadequate for the spring and summer.

Wash your plates well ; wash your negatives well ; wash your prints well ; and wash yourself well.

To take quick pictures, practise cleanliness. Clean lenses, clean camera, clean windows, clean glasses, clean chemicals, clear air, and a clear head, are all necessary in working quickly.

Keep your apparatus all in good order. Do not put them away with anything defective. Nothing can be depended on if there is a screw loose anywhere.

Avoid the use of wide-angle lenses when the ordinary ones will do. They are dangerous tools to use.

Extremes of heat and cold are not good for the photographer or his chemicals. In the hot weather they are difficult to control, from their exuberant activity ; in cold weather they are sluggish and torpid, and lose half their power. Moral : avoid extremes. Keep your camera, your chemicals, and yourself, cool in summer and warm in winter. Both you and they will work all the better with an equable temper and temperature.

Ventilation is the soul of health. Ventilate your dark room ; ventilate your bath, your camera, your tent, and your ideas.

Read, mark, learn, and inwardly digest the experience of others as exhibited in the Photographic Journals.

Don't be lead away by every fresh idea you hear. Don't expect to succeed with every new process you read of, but don't condemn it because it fails in your hands.



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5 " 4	...	2	3	8 $\frac{1}{2}$ " 6 $\frac{1}{2}$...	6	0
6 $\frac{3}{4}$ " 3 $\frac{1}{4}$...	3	2	9 " 7	...	7	6
6 $\frac{1}{2}$ " 4 $\frac{1}{4}$...	3	4	10 " 8	...	10	0
6 $\frac{1}{2}$ " 4 $\frac{3}{4}$...	3	6	12 " 10	...	15	0
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5 " 4				8 $\frac{1}{2}$ " 6 $\frac{1}{2}$...	9	6
6 $\frac{3}{4}$ " 3 $\frac{1}{4}$				9 " 7	...	10	0
6 $\frac{1}{2}$ " 4 $\frac{3}{4}$				10 " 8	...	11	6
7 $\frac{1}{4}$ " 4 $\frac{1}{2}$...	8	6	11 " 9	...	12	0
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1-4 size, or $4\frac{1}{4}$ by $3\frac{1}{4}$	1	6	2	0	2	6
1-3 " 5 " 4	1	10	2	6	3	0
1-2 " $6\frac{1}{2}$ " $4\frac{3}{4}$	2	0	2	8	3	6
" $7\frac{1}{4}$ " $4\frac{1}{2}$	2	9	3	6	4	0
1-1 " $8\frac{1}{2}$ " $6\frac{1}{2}$	2	10	3	9	4	3
" 9 " 7	3	6	4	6	5	6
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Ditto, Crystals in Tubes, 15 grs., 2s. ; 30 grs., 3s. 10d. ; 60 grs., 7s. 6d. each.

Borax, 2d. per ounce.

Acetate of Soda, 2d. per ounce.

Hypsulphite of Soda, 3d. per lb. ; 7 lbs. 1s. 2d.

ARTICLES REQUIRED FOR TRIMMING AND MOUNTING PRINTS.

GLASS SHAPING PLATES.

For Pictures,	$4\frac{1}{4}$	by	$3\frac{1}{4}$	...	...	...	...	...	0	9
"	5	"	4	...	...	...	...	...	1	0
"	$6\frac{1}{2}$	"	$4\frac{3}{4}$	...	...	...	...	...	1	6
"	$8\frac{1}{2}$	"	$6\frac{1}{2}$	...	...	...	...	...	2	3
"	10	"	8	...	...	...	...	...	3	6
"	12	"	10	...	...	...	...	...	4	6

TRIANGLES—10 by 8, 3s.; 12 by 10, 4s. 6d. each.

TRIMMING KNIVES for using with the above, with Handles, 1s. each.

CARDBOARDS—PLAIN— CUT TO THE FOLLOWING SIZES.

					4-Sheet.	6-Sheet.	8-Sheet.	Toned
					s. d.	s. d.	s. d.	6-Sheet. s. d.
$6\frac{1}{2}$	by	$4\frac{1}{4}$	Cabinet size, per 100...	...	3 0	...	—	...
8	"	6	per doz.	...	0 8	...	1 0	...
10	"	8	"	...	1 0	...	1 6	...
12	"	10	"	...	1 6	...	2 0	...
13	"	11	"	...	1 6	...	2 6	...
15	"	12	"	...	2 0	...	3 0	...
17 $\frac{1}{2}$	"	13 $\frac{1}{2}$	"	...	2 6	...	3 6	...
				...	—	...	3 6	...
							—	...

CARDBOARDS, WITH INDIA TINTS.

No.	Size of Tint.		Size of Board.		Per 100.	Per 1000.
1064	...	$3\frac{1}{2}$ by $5\frac{1}{4}$...	$6\frac{1}{4}$ by $8\frac{1}{4}$ ...	...	£0 6 0	£2 15 6
1065	...	$5\frac{1}{4}$ " 6 ...	$8\frac{1}{2}$ " $10\frac{1}{2}$ ...	...	0 9 0	4 4 0
1066	...	6 " 8 ...	9 " 12 ...	...	0 12 6	5 12 0
1067	...	$8\frac{1}{4}$ " $10\frac{1}{2}$...	12 " $15\frac{1}{4}$ ...	...	1 4 0	11 4 0
1068	...	10 " $12\frac{1}{4}$...	$13\frac{1}{2}$ " $17\frac{1}{2}$ ...	...	1 9 6	14 4 0
1069	...	$11\frac{1}{2}$ " $13\frac{3}{4}$...	17 " $21\frac{1}{4}$ ...	...	2 4 6	21 4 0
1070	...	$12\frac{1}{2}$ " $15\frac{1}{2}$...	$18\frac{1}{2}$ " $24\frac{1}{2}$ ...	...	3 1 0	20 4 0
1071	...	$14\frac{1}{4}$ " 18 ...	$19\frac{1}{4}$ " $25\frac{1}{2}$ ...	...	3 3 6	30 16 0
1072	...	$4\frac{3}{4}$ " $6\frac{1}{4}$...	$8\frac{1}{2}$ " $10\frac{3}{4}$ ...	...	0 9 0	4 4 0

The thickness of the Boards increases with the size.

MOUNTING SOLUTION, 1s. and 2s. 6d. per bottle.

PRINTING FOR AMATEURS

Executed in the best style. Silver Prints—Unmounted.

						s.	d.
4 $\frac{1}{4}$	by	3 $\frac{1}{4}$	(on Carte-de-Visite)	per doz	...	...	2 0
5	"	4	"	"	...	...	3 0
6 $\frac{1}{2}$	"	4 $\frac{3}{4}$	(Cabinet and Stereoscopic)	per doz.	...	...	4 0
7 $\frac{1}{4}$	"	4 $\frac{1}{2}$	"	"	...	...	5 0
8 $\frac{1}{2}$	"	6 $\frac{1}{2}$	"	"	...	...	7 0
9	"	7	"	"	...	...	7 6
10	"	8	"	"	...	...	10 0
12	"	10	"	"	...	...	15 0

Mounted and Rolled at about double the above prices.

Enlarging and Colouring Undertaken on Moderate Terms.

INSTRUCTIONS IN DRY PLATE MANIPULATION

Given to Amateurs by appointment. Terms, 21s. per Lesson, not exceeding one hour, including use of apparatus, studio, dry plates, and chemicals.

J. WERGE,

MANUFACTURER OF

PHOTOGRAPHIC APPARATUS, DRY PLATES,
AND CHEMICALS,

And Dealer in Photographic Requisites.

11A, BERNERS STREET, OXFORD STREET,
LONDON, W.